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COMMAND LINE WAS: SNAP3 FLEX,,,PROC;GBQLX

INCLUSION A: PROCPARM/TXT
INCLUSION B: PMACMIC/TXT
INCLUSION C: GMACROZ/TXT
INCLUSION D: PORTASGN/TXT
INCLUSION E: PROCEQUS/TXT
INCLUSION F: MDEF1800/TXT
INCLUSION G: BDEF1800/TXT
INCLUSION H: PORTEQUS/TXT
INCLUSION I: DDEF1800/TXT
INCLUSION J: HDEF1800/TXT

PROGRAM NAME: FLEX

PROGRAM ADDRESS BLOCKS:       010000    /ABSOLUTE/  SIZE=000000  (ABS)
                              167400    /SYSIVR/    SIZE=000400  (ABS)
                              170000    /SYSROM/    SIZE=000047  (ABS)
                              004000    /FLEXL/     SIZE=002000  (ABS)
                              000000    /FLEXP/     SIZE=004000  (REL)

EXTERNAL DEFINITIONS:

MBPAGE    004000              FXID      005231              FXSTAT    005652              UBIO      005671
INFO      005730

EXTERNAL REFERENCES (UNDEFINED SYMBOLS):

SRVBSN    SRVDO     SRVRPT    FETCH     FETCHI    IVIOL$

UNUSED LABELS:

DOREAD    FDINIT
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```
          INC     PROCPARM
*
. 2.9.K  HJS     17 APR 78             SETUP FOR RELOCATABLE & USING LESS REGS
. 2.9.J  HJS     17 MAR 78             OPTIMIZE HDR CHECK IF NO SRVREQ PENDING
. 2.9.H  HJS     13 FEB 78             MEMPF EVERYWHERE (CORRECT MBSTAT)
. 2.9.G  HJS     30 JAN 78             ADD COMMENTS (MINOR FIXES TOO)
. 2.9.F  HJS     12 JAN 78             FIX WRITE BIAS CURRENT BUG (FINALLY?)
. 2.9.C  HJS     12 DEC 77             FIX BUGS - INFO - SYSTAT ADDED
. 2.9.B  HJS     20 NOV 77             FIX MINOR BUGS
. 2.9.A  HJS     14 NOV 77             APF FIX AND PADDING MOD
*
. 2.8.B  HJS     22 SEP 77             FIX BUGS CREATED WHEN ROOM MADE
. 2.8.A  HJS     16 SEP 77             MAKE ROOM FOR MTI CRC ROUTINE
*
. 2.7.   HJS      7 SEP 77             BUG-FIX AND MINOR MODES FOR NEW RELEASE
*
. 2.H.B  HJS     31 AUG 77             CONVERTED FOR MTI VERSION (CRC)
*
. 2.5.C  HJS     16 AUG 77             CORRECTED THE COMMENTS AS NEEDED
. 2.5.A  HJS     12 JULY 77            UPDATE TO MATCH VRP CONTROL FORMAT
*
```

```
                       +
                       .    HELPFUL INFORMATION (I HOPE):
                       .
                       . *****************************************************************************
                       . IF WRITE SINGLE, DO IT, IF HEADER WAS IN THE DATA FIELD, USER DESERVES WHAT
                       . THE USER GETS BECAUSE WAS DOUBLE DENSITY DATA SECTOR
                       . *****************************************************************************
                       . IF WRITE DOUBLE AND GET D.C. GAP FAILURE (CHECK THAT THAT WAS IT)
                       . MARK THAT A MISTAKE SEEN AND ATTEMPT TO RE-READ A HEADER AGAIN,
                       . IF HEADER FOR WRONG SECTOR THEN RE-READ HEADER AGAIN ALSO.
                       . *****************************************************************************
                       . DOCUMENT THAT DUE TO COMMON CODE  FDWPI, FDVRS & FDVRD CAN GET MEMORY FAULTS
                       . FROM WHERE HL POINTS (ACCESS PROTECT INCLUDED)
                       . *****************************************************************************
                       . NOTE:::
                       . DUE TO BUFFER CYCLE TIMES A BUFFER ACCESS CAN NOT HAPPEN CLOSER THAN
                       . 1 MICRO-SEC. FROM ANOTHER (FOR DISK OR FROM MICRO-PROC.)
                       . FOR SAFETY THIS CODE KEEPS ALL ITS ACCESSES OVER 2 MICRO-SEC APART,
                       . THE COMMANDS THAT DO IMMEDIATE CYCLES ARE:
                       . FCOUTC, FCINDT, FCOTUP, FCWDGP, FCWRTN
                       . *****************************************************************************
                       . NOTE:: AGAIN ::
                       . LOADING MICRO-PROCESSOR POINTER DOES AN IMMEDIATE BUFFER READ ANTICIPATING
                       . AN FCINDT (DATA IS PRE-READ) THEREFORE FCOTUP MUST ALWAYS OCCUR AFTER DISK
                       . READ OPERATION HAS COMPLETED.
                       . *****************************************************************************
                       *
 004000                FLEXL    ORG    FLEX                  LOGICAL SPACE DEFINED IN PLACE
 000000                FLEXP    ORG    0                     PHYSICAL SPACE RELOCATABLE
 004000                FLEXL    USE    FLEXL                 USE THEM BOTH
 000000                         USE    FLEXP                 PUT THE CODE IN PHYSICAL SPACE
 004000L               FLEXP    LOC    FLEXL,2               WITH ADDRESSES IN LOGICAL SPACE
```

```
*
. INTERRUPT SERVICE ROUTINE
.BSDO
.       BEGIN
.       MBIAK (IAKODE);                                 FIND WHO MAKING NOISE & WHY
.         STB    MIFIAK
.         MBIN   NOOP
.         LDRT   TEMP1                      ALIAS IAKODE
.       IF MBSTAT <> NOTHINGTODO
.       THEN IF (IAKODE .AND. FIADR) = MADR       AM I INTERESTED IN DEVICE?
.            THEN MBPAGE;                         YES, SERVICE INTERRUPT
.         LDTR   MBSTAT
.         BRA    BSDON,TZ
.         DOTRR  ,XR,MADR,TEMP1
.         BPGX   MBPAGE
.         TSTIT  ,FIADR
.         BRA    MBPAGE,TZ
.         BPGX   $
.BSDON
.       TEMP := IAKODE .AND. FIADR;
.       MBUS (TEMP, FCOINT, 0);                   NO, DON'T WANT ANY MORE
.       MBUS (TEMP, FCLEAR, FKMAST-FKRWMF);       NOISE FROM INTERRUPTER
.         DORIR  TEMP1,NO,FIADR,TEMP1
.         MBUS   ,FCOINT,0
.         MBUS   TEMP1,FCLEAR,FKMAST-FKRWMF
.        RETURN HERE FROM DISKETTE SERVICE TO DO OTHER BUT ONLY DISPLAY DOES IT
.       IF SCDSPNL IN SRVREQ
.       THEN RETURN (SRVRTW)
.       RETURN (DL$DO)
.SRVBSN
.         LDPT   SRVREQ
.         TSTIT  ,SCDSPNL
.         BRA    SRVRTW,TZ
.DLDO
.         BRAX   DL$DO
.       END BSDO;
```

**** INTERRUPT DRIVEN DISKETTE INTERFACE ****

```
                              *
                              *
004000L                       MBPAGE:
                              .      BEGIN
                              .      IAKODE := IAKODE .AND. FINUM;           GET INTERRUPT NUMBER
                              .      MBUS (MADR, FCOMOD,
                              .           FOLOAD + FODR0 + (MBITS .AND. FRDRV));   SET CORRECT DRIVE
004000L                       MBSTRT                                 (SPECIAL ENTRY ON FDCMD - HEAD READ)
                              .                                      (GOES TO HDRERD THROUGH HDSTRT)
004000L 01010101 01110000       DORI   TEMP1,ND,FINUM                T-REG ALREADY HOLDS IAKODE
004001L 01101111 11110001
004002L 00010001 10110100       DOTIR  ,ND,FRDRV,MBITS,CC
004003L 01010101 00000001
004004L 11001100 11111011       MBWAIT
004005L 01010010 00000101       DOPI   MIFDAT,AC,FOLOAD+FODR0
004006L 00110111 00100111
004007L 00010001 11110011       MBUSAS MADR,FCOMOD
004010L 01010011 10010000
004011L 00110111 00100110
004012L 00110111 00101001
                              .      IF IAKODE <> FIINDX
                              .      THEN EXIT (MBSTAT);                     GO TO STATE SERVICE ROUTINE
004013L 01110001 10110001       TSTIR  XR,FIINDX,TEMP1,CC     (CC FOR HDSTRT SPECIAL CASE)
004014L 01000000 00110000
004015L 10000010 00000101       BRR    MBSTAT,FZ
                              .      MBITS := MBITS + FRIXCT;                COUNT INDEX INTERRUPTS
                              .      IF CARRY
                              .      THEN EXIT (FXIOER);                     TOO MANY INDEX PULSES IS BAD
                              .      EXIT (HDRERD)                           RESTART OPERATIONS
004016L 00010001 10110100       DORIR  MBITS,AC,FRIXCT,MBITS,CC
004017L 01010010 01000000
004020L 00000111 11110100
004021L                       HDSTRT                                 (INDIRECT LINK TO HDRERD FOR FDCMD)
004021L 11010000 01001001       BRA    HDRERD,FC              (SO I/O TO DISKETTE STOPPED)
                              .        BRA    FXIOER
                              .      END MBPAGE;
                              *
004022L                       MEMPFDS                                (USED ONLY BY APF MEMORY FAULT FROM)
                              .                                      (TRACK/SECTOR NUMBERS IN RAM)
004022L                       FXIOER
                              .      BEGIN
                              .      MBITS := MBITS .XOR. (FRBUSY + FRINDX);  OFF BUSY, ON INDEX ERROR
004022L 01010001 00000110       LDTI   FRBUSY+FRINDX
                              .      EXIT (PENDR)                            FINISHED
004023L 11001111 11101000       BRA    PENDR
                              .      END FXIOER;
```

```
                                  +
                                  *
004024L                           DONIO
                                  .      BEGIN
                                  .      IF FITROK <> IAKODE                       MAKE SURE ENDED CORRECTLY
                                  .      THEN EXIT (HDREAD);                       NO, THEN TRY AGAIN
004024L 01000000 01010000                  TSTIT  XR,FITROK
004025L 11010010 01000010                  BRA    HDREAD,FZ
                                  .      MBITS := MBITS .AND. -1-FRBUSY;
004026L 01010001 00000010                  LDTI   FRBUSY
                                  .      EXIT (PENDR)
                                  .        BRA    PENDR
                                  .      END DONIO;
                                  *
004027L                           PENDR
                                  . 2.40
                                  .      BEGIN
004027L 00010000 11110100                  DORR   MBITS,XR,MBITS          (COMMON CODE SAVINGS)
004030L 00000111 11110100
                                  .      MBUS (MADR, FCOINT, 0);                   CLEAR INTERRUPTS AND MASK
                                  .      MBSTAT := NOTHINGTODO;
                                  .      MBUS (MADR, FCLEAR, FKMAST + FKLOFF);
004031L 00010001 11110011                  MBUS   MADR,FCOINT,0
004032L 01010011 10110000
004033L 11001100 11100100
004034L 00110111 00100110
004035L 01010001 00000000
004036L 00110111 00100111
004037L 00110111 00101001
004040L 01010001 00000000                  BAL    MBSTAT,-1               (NOTHING-TO-DO IS ZERO!)
004041L 00000111 11110101
                                  .                                       (SAVE 1 WORD POSSIBLE, BUT SLOWER)
004042L 00010001 11110011                  MBUS   MADR,FCLEAR,FKMAST+FKLOFF
004043L 01010011 00110000
004044L 11001100 11011011
004045L 00110111 00100110
004046L 01010001 01111111
004047L 00110111 00100111
004050L 00110111 00101001
                                  .NOTHINGTODO:                                    DOES NOTHING!
                                  .      RETURN (SRVBSN)
>004051L 01011001 11111111                 BRAX   SRVBSN
>004052L 11001111 11111111
                                  .      END PENDR;
                                  .
```

```
                               *
 004053L                       DBLRED
                               .       BEGIN
                               .       IF (FIPNTR <> IAKODE) OR                 MUST BE POINTERS NOT EQUAL
                               .            NOT FSGAP IN MBIN (MADR, FCINST)    AND MUST SEE D.C. GAP
                               .       THEN  EXIT (HDRERD)                      OR GIVE UP & START AGAIN
 004053L 01000000 01110000               TSTIT  XR,FIPNTR              (IAKODE IN T-REG)
 004054L 11010010 01001001               BRA    HDRERD,FZ
 004055L 00010001 11110011               MBUS   MADR,FCINST
 004056L 11001100 11010001
 004057L 00110111 00100110
 004060L 00110111 00101001
 004061L 01010001 00010000               LDTI   FSGAP
 004062L 11001100 11001101               MBTIN
 004063L 00110101 00010101
 004064L 11010011 01001001               BRA    HDRERD,TZ
                               .       MBUS (MADR, FCOINT, FMINDX+FMTROK+FMTRER);  ALLOW NORMAL INTERRUPTS
                               .       MBSTAT := DONIO;                         NOW THAT KNOW IS DOUBLE
                               .       MBUS (MADR, FCLEAR, FKPNTR);             CLEARING PNTR INTERRUPT
 004065L 00010001 11110011               MBUS   MADR,FCOINT,FMINDX+FMTROK+FMTRER   (JF,BR WASTED)
 004066L 01010011 10110000
 004067L 11001100 11001000
 004070L 00110111 00100110
 004071L 01010001 00001101
 004072L 00110111 00100111
 004073L 00110111 00101001
 004074L 01010001 11101011               BAL    MBSTAT,DONIO
 004075L 00000111 11110101
 004076L 00010001 11110011               MBUS   MADR,FCLEAR,FKPNTR
 004077L 01010011 00110000
 004100L 11001100 10111111
 004101L 00110111 00100110
 004102L 01010001 00010000
 004103L 00110111 00100111
 004104L 00110111 00101001
                               .       RETURN (SRVBSN)                          CONTINUE AS NORMAL
>004105L 01011001 11111111               BRAX   SRVBSN
>004106L 11001111 11111111
                               .       END DBLRED;
                               .
```

```
                                      *
004107L                               HDRCHK
                                      . 17.30 OR 24.95 IF WORST BAD CASE *** CHANGED AGAIN ***
                                      .       BEGIN
                                      .       IF FITROK <> IAKODE                        ONLY TRANSFER OK ALLOWED INT
                                      .       THEN EXIT (HDREAD);
004107L 01000000 01010000                       TSTIT  XR,FITROK
004110L 11010010 01000010                       BRA     HDREAD,FZ
                                      .       MBUS (MADR, FCOTUP, FPTRKH>1);             SET MICRO-POINTER
                                      .       MBUS (MADR, FCOINT, FMINDX+FMPNTR);        POINTERS NOT EQUAL ONLY
                                      .       MBSTAT := HDRCHK1;
                                      .       MBUS (MADR, FCLEAR, FKMAST+FKLOFF);        DONE & I/O FINISHED
004111L 00010001 11110011                       MBUS    MADR,FCOTUP,FPTRKH>1
004112L 01010011 01010000
004113L 11001100 10110100
004114L 00110111 00100110
004115L 01010001 00000001
004116L 00110111 00100111
004117L 00110111 00101001
004120L 00010001 11110011                       MBUS    MADR,FCOINT,FMINDX+FMPNTR
004121L 01010011 10110000
004122L 11001100 10101101
004123L 00110111 00100110
004124L 01010001 00010001
004125L 00110111 00100111
004126L 00110111 00101001
004127L 01010001 10000110                       BAL     MBSTAT,HDRCHK1
004130L 00000111 11110101
004131L 00010001 11110011                       MBUS    MADR,FCLEAR,FKMAST+FKLOFF
004132L 01010011 00110000
004133L 11001100 10100100
004134L 00110111 00100110
004135L 01010001 01111111
004136L 00110111 00100111
004137L 00110111 00101001
004140L                               HDRCOM                               (COMMON HEADER GET DATA BYTE ROUTINE)
                                      . 11.95 OR *** CHANGED AGAIN *** 20.10 IF ERROR
                                      .       BINDEL (HDREAD, TEMP);                     COMPRESS DATA BYTE
                                      .       CRCGENX (TEMP);                            DO CRC FOR IT -*- DELAYED
                                      .       MDSKS := TEMP;                             IT IS TRACK OR SECTOR NUMBER
004140L 00010001 11110011                       MBUSAW MADR,FCINDT                 (PRE-SELECT BUS ADDR-FUNCTION)
004141L 01010011 00010000
004142L 11001100 10011101
004143L 00110111 00100110
004144L 01010001 10011000                       BRC     BINDEL,,$+3
004145L 11001111 00101101
004146L 11011111 01000010                       BRA     HDREAD
004147L 00000111 11111000                       LDRT    MDSKS
                                      .       IF SOCLK <> MBIN (MADR, FCINDT)            ZERO FOLLOWS TRACK/SECTOR #
                                      .       THEN EXIT (HDREAD);
                                      .       IF SOCLK <> MBIN (MADR, FCINDT)
                                      .       THEN EXIT (HDREAD);
```

```
                                 .       CRCGEN (0);                            DO CRC FOR ZERO - DELAYED
 004150L 00110111 00101001                 STB    MIFSTB
 004151L 01010001 10101010                 LDTI   SOCLK
 004152L 11001100 10010101                 MBTIN  XR
 004153L 00110000 00010101
 004154L 11010010 01000010                 BRA    HDREAD,FZ
 004155L 01010001 10010000                 BRC    CRCGENX               (DELAYED CRCGENX (TEMP) - NEEDED HERE)
 004156L 11001111 01010010
                                 .                                      (FOR TIMING DELAY BETWEEN MIFSTB'S)
 004157L 00110111 00101001                 STB    MIFSTB
 004160L 01010001 10101010                 LDTI   SOCLK
 004161L 11001100 10001110                 MBTIN  XR
 004162L 00110000 00010101
 004163L 11010010 01000010                 BRA    HDREAD,FZ             (ERROR EXIT, BAD DATA)
                                 .       IF SRVREQ .AND. .NOT. (SCMBUS .OR. SCHUMS)
                                 .       THEN RETURN (SRVDO)
                                 .       ELSE EXIT (MBSTAT);
 004164L 00110001 00110000                 TSTIP  ND,-1-SCMBUS-SCHUMS,SRVREQ,TW  (IGNORE 100 MICRO-SEC)
 004165L 01010101 10111101
 004166L 10000011 00000101                 BRR    MBSTAT,TZ             (DON'T EXIT IF NO SERVICE TO DO)
>004167L 01011001 11111111                 BRAX   SRVDO                 (GO RIGHT TO THE SERVICE)
>004170L 11001111 11111111
                                 *
                                           IFS    APF
 004171L 11000100 10000110       HDRCHK1   MWAIT  ,MEMPFDS
 004172L 11000111 11101101
 004173L 01010001 01100111                 DLDPI  MARO,SVMTRAK,,SMR     (READ THE TRACK NUMBER IN MEMORY)
 004174L 00110111 11000000
 004175L 01010001 11101111
 004176L 00110111 11100000
 004177L 00110111 01000111
 004200L 00010001 11111000                 LDRR   MDSKT,MDSKS
 004201L 00000111 11111001
 004202L 11000100 01111101                 MWAIT  ,MEMPFDS
 004203L 11000111 11101101
 004204L 00110000 00110110                 TSTPT  XR,MDR
                                           XIF
                                           IFC    APF
                                           XIF
 004205L 11010010 01000010                 BRA    HDREAD,FZ
                                 .       MBSTAT := HDRCRC
 004206L 01010001 01110101                 BAL    MBSTAT,HDRCRC
 004207L 00000111 11110101
 004210L 01010001 10011111                 BRC    CRCGEN,,HDRCOM        (FROM DELAY OF ZERO CRC)
 004211L 11001111 01001101
                                 .                                      (AND USE COMMON CODE TO GET SECTOR #)
 254.                               *
 255,                                       IFS    APF
 256.  004212L 11000100 01110101   HDRCRC   MWAIT  ,MEMPFDS
       004213L 11000111 11101101
 257.  004214L 01010001 01100110            DLDPI  MARO,SVMSECT,,SMR      (READ THE TRACK NUMBER EARLY)
       004215L 00110111 11000000
       004216L 01010001 11101111
       004217L 00110111 11100000
       004220L 00110111 01000111
 258,                                       XIF
 259,                                       IFC    APF
 262,                                       XIF
 263,                               . 16.90 TO HDROK NORMAL (+ 0.40 IF READ SECTOR ZERO)
 264.                               .      + ADD TOTALS FOR EACH INDEPENDENT ROUTINE
 265,                               . 24.95 IF WRONG SECTOR NUMBER
 266,                               . 25.25 IF NOT SECTOR ZERO
 267,                               . 24.45 IF WORST CASE BAD DATA
 268.                               .     IF MCRCH <> BINDEL (HDREAD, TEMP)         CHECK CRC MSB
 269.                               .     THEN EXIT (HDREAD);
 270.  004221L 00010001 11110011              MBUSAW MADR,FCINDT
       004222L 01010011 00010000
       004223L 11001100 01101100
       004224L 00110111 00100110
 271.  004225L 01010001 01101000            BRC    CRCGEN                 (HERE WHERE TIMING DELAY NEEDED)
       004226L 11001111 01001101
 272.  004227L 01010001 01100101            BRC    BINDEL,,$+3
       004230L 11001111 00101101
 273,  004231L 11011111 01000010            BRA    HDREAD                 (ERROR EXIT, BAD DATA)
 274.  004232L 00010000 11000110            TSTRT  XR,MCRCH
 275,  004233L 11010010 01000010            BRA    HDREAD,FZ              (ERROR EXIT, BAD DATA)
 276,                               .     IF MCRCL <> BINDEL (HDREAD, TEMP)         CHECK CRC LSB
 277,                               .     THEN EXIT (HDREAD);
 278.  004234L 01010001 01100000            BRC    BINDEL,,$+3
       004235L 11001111 00101101
 279.  004236L 11011111 01000010            BRA    HDREAD                 (ERROR EXIT, BAD DATA)
 280,  004237L 00010000 11000111            TSTRT  XR,MCRCL
 281,  004240L 11010010 01000010            BRA    HDREAD,FZ              (ERROR EXIT, BAD DATA)
 282.                               .     IF (MDSKS <> MSECT) &                     SECTOR NUMBER CORRECT??
 283,                               .          (MSECT <> 0 OR NOT FFREAD IN MBITS)  NO, WILL ANY DO - ON READS
 284,                               .     THEN EXIT (HDREAD);                       CAN'T OPERATE ON THAT SECTOR
 285,                                       IFS    APF
 286.  004241L 11000100 01011110            MWAIT  ,MEMPFDS
       004242L 11000111 11101101
 287.  004243L 00110001 00110110            TSTRP  XR,MDSKS,MDR
       004244L 00010000 11001000
 288,                                       XIF
 289,                                       IFC    APF
 291,                                       XIF
 292,  004245L 11000011 01010100            BRA    HDROKX,TZ
 293,  004246L 00010111 11000010            TSTRT  FT,Q                   (RESET ZERO FLAG ON MSECT VALUE)
 294,  004247L 11010010 01000010            BRA    HDREAD,FZ              (DID NOT ASK FOR SECTOR ZERO)
 295.  004250L 00010001 11110100            TSTIR  ,FFRMSK,MBITS
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004251L 01000101 00100000
004252L 11010010 01000010            BRA    HDREAD,FZ             (OR WAS NOT READ OPERATION)
004253L 01011001 11110101   HDROKX   BRAX   HDROK
004254L 11001111 11111111
                            .         IT'S OK, USE THAT SECTOR
                            .        EXIT (HDROK)
                            .        END HDRCHK;
```

```
                              *
004255L                       CRCGENX
                              ** 3.7 **
                              .      BEGIN
                              .      MCRCH := MCRCH .XOR. TEMP2;
                              .      EXIT (CRCGEN)
                              .      END CRCGENX;
004255L 01101111 11110000       BAS    LINK
004256L 00010001 11110110       DORRR  MCRCH,XR,TEMP1,MCRCH
004257L 01110000 11110001
004260L 00000111 11110110
004261L 11001111 01001011       BRA    CRCGENY
                              *
004262L                       CRCGEN
                              .                                      GENERATE 'SDLC' TYPE CRC
                              ** 3.3 **
                              .      BEGIN
                              .      TEMP2 := MCRCH .XOR. (MCRCH<4 .AND. 017);
                              .      MCRCH := MCRCL;
                              .      MCRCL := TEMP2;
                              .      TEMP2 := MCRCL<4;
                              .      MCRCH := MCRCH .XOR. (TEMP2 .AND. 0360);
                              .      TEMP2 := TEMP2<1;
                              .      MCRCH := MCRCH .XOR. (TEMP2 .AND. 037);
                              .      MCRCL := MCRCL .XOR. (TEMP2 .AND. 0340);
                              .      RETURN
                              .
                              . ENTER: MCRCH  IS MCRCH .XOR. DATA
                              .        MCRCL  IS MCRCL
                              . EXIT:  MCRCH & L, IS THE NEW CRC
                              .        T-REG  IS MCRCL
                              .
                              .
                              .RESULT BITS ARE:  (MADE FROM XOR OF COLUMNS)
                              .BIT 15  14  13  12  11  10   9   8   7   6   5   4   3   2   1   0
                              . IS
                              .    C7  C6  C5  C4  C3  C2  C1  C0
                              .   C15 C14 C13 C12                 C15 C14 C13 C12 C11 C10  C9  C8
                              .    D7  D6  D5  D4                  D7  D6  D5  D4  D3  D2  D1  D0
                              .   C11 C10  C9  C8                                 C15 C14 C13 C12
                              .    D3  D2  D1  D0                                  D7  D6  D5  D4
                              .                   C15 C14 C13 C12 C11 C10  C9  C8
                              .                    D7  D6  D5  D4  D3  D2  D1  D0
                              .                                   C15 C14 C13 C12
                              .                                    D7  D6  D5  D4
                              .
                              . OR IN SHORTER FORM:
                              .    C7  C6  C5  C4  C3  C2  C1  C0
                              .     M   N   O   P                   I   J   K   L   M   N   O   P
                              .                     I   J   K   L   M   N   O   P
                              . WHERE I..P IS:
                              .                   C15 C14 C13 C12 C11 C10  C9  C8
                              .                    D7  D6  D5  D4  D3  D2  D1  D0
```

```
                                 .                                  C15 C14 C13 C12
                                 .                                   D7  D6  D5  D4
                                 .
004262L 01101111 11110000                  BAS     LINK
004263L 00010001 11110110                  LDTR    MCRCH
004264L                          CRCGENY
                                           RPT     4
004264L 00010111 10100010                  SHIFT   SL
004265L 00010111 10100010                  SHIFT   SL
004266L 00010111 10100010                  SHIFT   SL
004267L 00010111 10100010                  SHIFT   SL
004270L 01010101 00001111                  DOTI    ,ND,017
004271L 00010000 11110110                  DORR    TEMP2,XR,MCRCH         HAVE  I   J   K   L   M   N   O   P
004272L 01101111 11110010
004273L 00010001 11110111                  LDRR    MCRCH,MCRCL            HAVE C7   6   5   4   3   2   1   0
004274L 00000111 11110110
004275L 01110001 11110010                  LDRR    MCRCL,TEMP2
004276L 00000111 11110111
                                           RPT     4
004277L 00010111 10100010                  SHIFT   SL
004300L 00010111 10100010                  SHIFT   SL
004301L 00010111 10100010                  SHIFT   SL
004302L 00010111 10100010                  SHIFT   SL
004303L 01101111 11110010                  LDRT    TEMP2                  SAVE  M   N   O   P   I   J   K   L
004304L 01010101 11110000                  DOTI    ,ND,0360               GET   M   N   O   P
004305L 00010000 11110110                  DORR    MCRCH,XR,MCRCH         HAVE 7M  6N  5O  4P   3   2   1   0
004306L 00000111 11110110
004307L 01110001 11110010                  DORRR   TEMP2,FT,Q,TEMP2,CC+SL HAVE  N   O   P   I   J   K   L   M
004310L 00010111 10100010
004311L 01101111 11110010
004312L 01010101 00011111                  DOTI    ,ND,037                GET               I   J   K   L   M
004313L 00010000 11110110                  DORR    MCRCH,XR,MCRCH         HAVE 7M  6N  5O  4PI 3J  2K  1L  0M
004314L 00000111 11110110
004315L 01110001 11110010                  DOTIR   ,ND,0340,TEMP2         GET   N   O   P
004316L 01010101 11100000
004317L 00010000 10110111                  DORR    MCRCL,XR,MCRCL,,CC     HAVE IN  JO  KP  L   M   N   O   P
004320L 00000111 11110111
004321L 11101111 00000000                  BRR     LINK
                                 .      END CRCGEN;
```

```
                              *
                              *
004322L                       BINDEL
                              .                                      ROUTINE TO INPUT BYTE & CLOCK DELETE IT
                              ** 4.8 **   1.50 IF ERROR ON FIRST BYTE, 3.70 IF ERROR ON SECOND
                              . BINDEL (ERRADR, BYTE):
                              .       BEGIN
                              .       T := MBIN (MADR, FCINDT) .XOR. SOCLK;
                              .       IF SOCLK IN T
                              .       THEN RETURN (ERRADR);
                              .       TEMP1 := (T [6, 4, 2, 0], 0, 0, 0, 0);
                              .       T := MBIN (MADR, FCINDT) .XOR. SOCLK;
                              .       IF SOCLK IN T
                              .       THEN RETURN (ERRADR);
                              .       TEMP1 := TEMP1 .OR. (0, 0, 0, 0, T [6, 4, 2, 0]);
                              .       MCRCH := MCRCH .XOR. TEMP1;              FOR CRCGENERATOR
                              *
                              . INPUTS TWO BYTES FROM THE DEVICE LAST ACCESSED (ASSUMING COMMAND & ADDR OK)
                              . ODD BITS MUST ALL BE ONE'S, AND EVEN BITS ARE SQUEEZED TOGETHER.
                              . THE FIRST BYTE INPUT DEFINES THE HIGH ORDER HEX DIGIT, AND THE SECOND BYTE
                              . DEFINES THE LOW ORDER HEX DIGIT. THEY ARE COMBINED AND RETURNED IN T-REG.
                              . IF AN ERROR IS SEEN, THE ROUTINE RETURNS TO ONE INSTRUCTION 'BEFORE'
                              . THE ONE SPECIFIED IN THE RETURN ADDRESS GIVEN IN THE T-REG WHEN CALLED.
                              .
004322L 00110111 00101001              MBUSS                          TO DO THE MSB
004323L 01101111 10110000              BAS     LINK,CC
004324L 01010001 10101010              LDTI    SOCLK                  1 0 1 0 1 0 1 0
004325L 11001100 00101010              MBWAIT
004326L 00110000 00010101              DOTP    ,XR,MIFIN              0 D 0 D 0 D 0 D
004327L 01000101 10101010              TSTIT   ,SOCLK
004330L 11000010 00000110              BRA     BINDER,FZ
004331L 01010010 01010101              DOTI    ,AC,0125               < - < - < - < -
004332L 01010101 10101010              DOTI    ,ND,0252               D 0 D 0 D 0 D 0
004333L 01010010 00101010              DOTI    ,AC,052                D < - < - < - 0
004334L 01010101 11010100              DOTI    ,ND,0324               D D 0 D 0 D 0 0
004335L 01010010 00010100              DOTI    ,AC,024                D D < - < - 0 0
004336L 01010101 11101000              DOTI    ,ND,0350               D D D 0 D 0 0 0
004337L 01010010 00001000              DOTI    ,AC,010                D D D < - 0 0 0
004340L 01010101 11110000              DOTI    ,ND,0360               D D D D 0 0 0 0  THE WHOLE NIBBLE IS UP
                                       RPT     2
004341L 11001111 00011101              BRA     $+1                    ** DELAY FOR 2.0  -SEC AT LEAST **
004342L 11001111 00011100              BRA     $+1                    ** DELAY FOR 2.0  -SEC AT LEAST **
004343L 00110111 00101001              MBUSS                          *EARLY (A LITTLE)*
004344L 01101111 10110001              LDRT    TEMP1,,CC
                              .                                      *SECOND HALF (LSB)*
004345L 01010001 10101010              LDTI    SOCLK                  1 0 1 0 1 0 1 0
004346L 11001100 00011001              MBWAIT
004347L 00110000 00010101              DOTP    ,XR,MIFIN              0 D 0 D 0 D 0 D
004350L 01000101 10101010              TSTIT   ,SOCLK
004351L 11000010 00000110              BRA     BINDER,FZ
004352L 01010010 01010101              DOTI    ,AC,0125               < - < - < - < -
004353L 01010101 10101010              DOTI    ,ND,0252               D 0 D 0 D 0 D 0
```

```
004354L 01010010 00101010                 DOTI   ,AC,052                 D < - < - < - 0
004355L 01010101 11010100                 DOTI   ,ND,0324                D D 0 D 0 D 0 0
004356L 01010010 00010100                 DOTI   ,AC,024                 D D < - < - 0 0
004357L 01010101 11101000                 DOTI   ,ND,0350                D D D 0 D 0 0 0
004360L 01010010 00001000                 DOTI   ,AC,010                 D D D < - 0 0 0
004361L 01010101 11110000                 DOTI   ,ND,0360                D D D D 0 0 0 0  THE WHOLE NIBBLE IS UP
                                          RPT    4                                  MOVE IT DOWN!
004362L 00010111 10100010                 SHIFT  SL                      LEFT 4 FASTER THAN RIGHT 5
004363L 00010111 10100010                 SHIFT  SL                      LEFT 4 FASTER THAN RIGHT 5
004364L 00010111 10100010                 SHIFT  SL                      LEFT 4 FASTER THAN RIGHT 5
004365L 00010111 10100010                 SHIFT  SL                      LEFT 4 FASTER THAN RIGHT 5
004366L 01110011 11110001                 DORR   TEMP1,OR,TEMP1          AND FINALLY COMBINE THEM
004367L 01101111 11110001
004370L 11101111 00000000                 BRR    LINK
                                   .
004371L 01110001 11110000          BINDER INCR   LINK,LINK               TAKE THE ERROR EXIT (BEFORE NORMAL!)
004372L 01101110 01110000
004373L 11101111 00000000                 BRR    LINK
                                   .      END BINDEL;
                                   *
004374L 11111111 11111111                 TABPAGE FLEXL
004375L 11111111 11111111
004376L 11111111 11111111
004377L 11111111 11111111
```

```
                                  +
                                  *
 004400L                          BOTINS
                                  .                              ROUTINE TO OUTPUT BYTE, CLOCK INSERTING
                                  ** 4.1 **
                                  , BOTINS (BYTE);
                                  .      BEGIN
                                  .      T := (1, BYTE [7], 1, BYTE [6], 1, BYTE [5], 1, BYTE [4]);
                                  .      MBUS (MADR, FCOUTC, T);
                                  .      T := (1, BYTE [3], 1, BYTE [2], 1, BYTE [1], 1, BYTE [0]);
                                  .      MBUS (MADR, FCOUTC, T);
                                  .      MCRCH := MCRCH .XOR. BYTE                FOR CRCGENERATOR
                                  *
                                  .
                                  . INPUTS A BYTE FROM TEMP1 AND OUTPUTS TWO BYTES
                                  . TO THE DEVICE LAST ACCESSED ON THE MICRO-BUSS (ASSUMING ADDR. & COMMAND OK)
                                  . THE MOST SIGNIFICANT INPUT NIBBLE BECOMES THE FIRST BYTE AND THE LEAST
                                  . SIGNIFICANT NIBBLE THE SECOND BYTE OUTPUT.
                                  . EACH NIBBLE GETS CLOCK BITS INSERTED BEFORE EACH BIT OF THE NIBBLE
                                  . TO SPREAD THE 4 BITS OUT TO FILL A BYTE.
                                  .
 004400L 01101111 11110000                 BAS     LINK
 004401L 01110001 11110001                 LDTR    TEMP1
                                           RPT     4                   ** MSB **  (CLEARS CARRY ALSO)
 004402L 00010111 10100010                 SHIFT   SL
 004403L 00010111 10100010                 SHIFT   SL
 004404L 00010111 10100010                 SHIFT   SL
 004405L 00010111 10100010                 SHIFT   SL
 004406L 01010101 00001111                 DOTI    ,ND,017             0 0 0 0 D D D D
 004407L 01010010 00001000                 DOTI    ,AC,010             0 0 0 < - D D D
 004410L 01010101 00010111                 DOTI    ,ND,027             0 0 0 D 0 D D D
 004411L 01010010 00010100                 DOTI    ,AC,024             0 0 < - < - D D
 004412L 01010101 00101011                 DOTI    ,ND,053             0 0 D 0 D 0 D D
 004413L 01010010 00101010                 DOTI    ,AC,052             0 < - < - < - D
 004414L 01010011 10101010                 DOTI    ,OR,SOCLK           1 D 1 D 1 D 1 D
 004415L 11011100 11110010                 MBWAIT
 004416L 00110111 00100111                 STB     MIFDAT,MIFSTB       **OUTPUT MS-NIBBLE **
 004417L 00110111 00101001
 004420L 01110001 11110001                 LDTR    TEMP1               ** LSB **
 004421L 01010101 00001111                 DOTI    ,ND,017             0 0 0 0 D D D D
 004422L 01010010 00001000                 DOTI    ,AC,010             0 0 0 < - D D D
 004423L 01010101 00010111                 DOTI    ,ND,027             0 0 0 D 0 D D D
 004424L 01010010 00010100                 DOTI    ,AC,024             0 0 < - < - D D
 004425L 01010101 00101011                 DOTI    ,ND,053             0 0 D 0 D 0 D D
 004426L 01010010 00101010                 DOTI    ,AC,052             0 < - < - < - D
 004427L 01010011 10101010                 DOTI    ,OR,SOCLK           1 D 1 D 1 D 1 D
 004430L 11011100 11100111                 MBWAIT
 004431L 00110111 00100111                 STB     MIFDAT              ** OUTPUT LS-NIBBLE **
                                           RPT     5
 004432L 11011111 11100100                 BRA     $+1                 ** DELAY FOR 2.0  -SEC AT LEAST **
 004433L 11011111 11100011                 BRA     $+1                 ** DELAY FOR 2.0  -SEC AT LEAST **
 004434L 11011111 11100010                 BRA     $+1                 ** DELAY FOR 2.0  -SEC AT LEAST **
```

```
  489,  004435L 11011111 11100001               BRA     $+1                   ** DELAY FOR 2.0  -SEC AT LEAST **
  489,  004436L 11011111 11100000               BRA     $+1                   ** DELAY FOR 2.0  -SEC AT LEAST **
  490,  004437L 00110111 00101001               MBUSS
  491,  004440L 11101111 00000000               BRR     LINK
  492,                                 .      END BOTINS;
  493.                                 .
```

```
                                 *
                                 . *
004441L                          FDFCNS
                                 ** TIMINGS GIVEN BELOW ARE TO LABEL 'FDF' WITH WHATEVER ROUTINE IS USED
                                 .
                                          IFS     APF
                                 *      CRC: CRCGEN ((MAR));                    ONLY CRC GENERATE
                                 .           MAR := MAR + 1;
                                 .           EXIT (FDF);
                                 ** 4.25 **
004441L 00110001 00110110                 LDTP    MDR
004442L 00110111 00001100                 STB     IMAR,SMR
004443L 00110111 01000111
004444L 00010000 11110110                 DORR    MCRCH,XR,MCRCH
004445L 00000111 11110110
004446L 01010001 10011000                 BRC     CRCGEN,,FDF
004447L 11001111 01001101
004450L 11001110 11111111                 NOOP
                                          XIF
                                 .
                                          IFC     APF
                                          XIF
                                 *
                                 .      WPI: MBUS (MADR, FCOUTC, SOCLK);        PREAMBLE INITIALIZE
                                 .           EXIT (FDF);
                                 ** 0.85 **
004451L 01010011 10100000                 MBUSA   ,FCOUTC
004452L 00110111 00100110
004453L 01010001 10101010                 LDPI    MIFDAT,SOCLK
004454L 00110111 00100111
004455L 00110111 00101001                 MBUSS
004456L 11011111 10011000                 BRA     FDF
004457L 11001110 11111111                 NOOP                        (PAD TO 8 WORDS)
004460L 11001110 11111111                 NOOP
                                 *
                                 .      OTD: MBUS (MADR, FCOUTC, TEMP := (MDR)); OUTPUT DOUBLE
                                 .           CRCGENX (TEMP);
                                 .           MAR := MAR + 1
                                 .           EXIT (FDF);
                                 ** 5.1 **
004461L 01010011 10100000                 MBUSA   ,FCOUTC
004462L 00110111 00100110
004463L 00110001 00110110                 MBUSP   MDR
004464L 00110111 00100111
004465L 01101111 11110001                 LDRT    TEMP1
004466L 00110111 00101001                 MBUSS
004467L 01010001 10011010                 BRC     CRCGENX,,FDFIS
004470L 11001111 01010010
```

PERFORM BUFFER - PROCESSOR OPERATIONS

```
                                   *
                                   .      OTS: BOTINS (TEMP := (MDR));          OUTPUT SINGLE
                                   .           CRCGENX (TEMP);
                                   .           MAR := MAR + 1
                                   .           EXIT (FDF);
                                   ** 9.20 **
004471L 01010011 10100000                 MBUSA  ,FCOUTC
004472L 00110111 00100110
004473L 00110001 00110110                 LDRP   TEMP1,MDR
004474L 01101111 11110001
004475L 01010001 11000000                 BRC    BOTINS
004476L 11011111 11111111
004477L 01010001 10011010                 BRC    CRCGENX,,FDFIS
004500L 11001111 01010010
                                   *
                                   .      VRD: TEMP := MBIN (MADR, FCINDT);     VERIFY DOUBLE
                                   .           CRCGENX (TEMP);
                                   .           EXIT (FDF);
                                   ** 5.45 **
004501L 01010011 00010000                 MBUSAS ,FCINDT
004502L 00110111 00100110
004503L 00110111 00101001
004504L 11001110 11111111                 MBIN   NOOP
004505L 11011100 10111010
004506L 00110001 00010101
004507L 01101111 11110001                 LDRT   TEMP1
004510L 11011111 10110001                 BRA    FDFINC
                                   *
                                   .      VRS: BINDEL (FDRDTA, TEMP);           VERIFY SINGLE
                                   .           CRCGENX (TEMP);
                                   .           EXIT (FDF);
                                   ** 9.35 **
004511L 01010011 00010000                 MBUSA  ,FCINDT
004512L 00110111 00100110
004513L 01010001 10110001                 BRC    BINDEL,,$+3
004514L 11001111 00101101
004515L 11011111 01001111                 BRA    FDRDTA
004516L                            FDFINC
004516L 01010001 10011000                 BRC    CRCGENX,,FDF
004517L 11001111 01010010
004520L 11001110 11111111                 NOOP
```

PERFORM BUFFER - PROCESSOR OPERATIONS

```
                                    *
                                    .     IND: (MAR) := TEMP := MBIN (MADR, FCINDT);   INPUT DOUBLE
                                    .          CRCGENX (TEMP);
                                    .          MAR := MAR + 1;
                                    .          EXIT (FDF);
                                    ** 6.15 **
004521L 01010011 00010000                   MBUSAS ,FCINDT
004522L 00110111 00100110
004523L 00110111 00101001
004524L 11001110 11111111                   MBIN    NOOP
004525L 11011100 10101010
004526L 00110001 00010101
004527L 01101111 11110001                   LDRT    TEMP1
004530L 11011111 10100001                   BRA     FDFINP
                                    .
                                            IFNE    $,(8-1)*8+FDFCNS       RTNS * WORDS + OFFSET
                                            XIF
                                    *
                                    .     INS: BINDEL (FDRDTA, (MAR) := TEMP);     INPUT SINGLE
                                    .          CRCGENX (TEMP);
                                    .          MAR := MAR + 1;
                                    .          EXIT (FDF);
004531L                             FDFTBL
                                    ** 10.05 **
004531L 01010011 00010000                   MBUSA   ,FCINDT
004532L 00110111 00100110
004533L 01010001 10100001                   BRC     BINDEL,,$+3
004534L 11001111 00101101
004535L 11011111 01001111                   BRA     FDRDTA
004536L                             FDFINP
004536L 00110111 00100001                   LDPT    MDW
004537L 01010001 10011110                   BRC     CRCGENX
004540L 11001111 01010010
004541L 11010100 10011110                   MWAIT   ,MEMPF4
004542L 11010111 10000110
004543L 00110111 00001100                   STB     IMAR
004544L 11011111 10011000                   BRA     FDF
                                    .
004545L                             FDFIS                                  (COMMON CODE ROUTINE)
004545L 00110111 00001100                   STB     IMAR,SMR
004546L 00110111 01000111
                                    .
```

```
                                   +
                                   . *
                                             IFNE    FDFCNS>8,$>8
                                             XIF
004547L                            FDF
                                   . 1,45    REPEAT
                                   . 2,30    END     (WITHOUT SERVICE TO FDTEND)
                                   . 3,65    SERVICE
                                   .                                        (CARRY CLEARED BY CRCGEN)
                                   .                                        (OR FOR WPI BY FCN CALLER)
                                   .       URC := URC - 1;                            COUNT THE WORDS GOING BY
004547L 00110001 11010010                    DOPIP   URO+URC,SB,1,URI+URC
004550L 01010100 00000001
004551L 00110111 10000010
                                   .       IF URC = 0
                                   .       THEN BEGIN
                                   .           MBSTAT := FDFLEND;                     END THE LOOPING
                                   .           URB := URB .XOR. 3                     MARK END PHASE NEXT
004552L 11010010 10001111                    BRA     FDFNXT,FZ
004553L 01010001 10001000                    BAL     MBSTAT,FDFLEND
004554L 00000111 11110101
004555L 00110001 11010001                    DOPIP   URO+URB,XR,3,URI+URB
004556L 01010000 00000011
004557L 00110111 10000001
                                   .           END
                                   .       IF SRVREQ = 0                              GO TO SERVICE SOMEBODY?
                                   .       THEN EXIT (MBSTAT);                        NO, KEEP ON GOING
004560L                            FDFNXT
004560L 11011100 10001111                    MBWAIT
004561L 11010100 10001110                    MWAIT   ,MEMPF4
004562L 11010111 10000110
004563L 00110001 00110000                    TSTPT   FI,SRVREQ
004564L 11010010 10001000                    BRA     FDFLEND,FZ
004565L 00010001 10110011                    LDTR    MADR,CC
004566L 10001111 00000101                    BRR     MBSTAT
004567L                            FDFLEND
                                   .       IF SRVREQ <> 0                             WAS IT SERVICE OR THE END?
                                   .       THEN EXIT (SRVRPT);
                                   .       EXIT (FDTEND)
004567L 00110001 00110000                    TSTPT   FI,SRVREQ
004570L 11010011 01110010                    BRA     FDTEND,TZ
                                   .       MBSTAT := URH;                             RESTORE THE REGISTERS
                                   .       URHL := MAR;
                                   .       MAR := URDE;
                                   .       URDE := MCRC;
                                   .       MCRC := MAR;
                                   .
004571L                            MEMPF4                                   (RESTORE STATE CORRECTLY BEFORE MEMPF)
                                   .
004571L 00110001 11010101                    LDRP    MBSTAT,URI+URH
004572L 00000111 11110101
004573L 00110001 11010110                    LDRP    MADR,URI+URL
```

```
       004574L 00000111 11110011
 655.  004575L 00110001 10000110                  DLDX   MR2HL
       004576L 00110001 10100101
 656.  004577L 00110001 11010100                  DLDRP  TEMP,URI+UDE
       004600L 01101111 11110010
       004601L 00110001 11010011
       004602L 01101111 11110001
 657.  004603L 00010001 11110111                  DLDPR  URO+UDE,MCRC
       004604L 00110111 10000100
       004605L 00010001 11110110
       004606L 00110111 10000011
 658.  004607L 01110001 11110010                  DLDRR  MCRC,TEMP
       004610L 00000111 11110111
       004611L 01110001 11110001
       004612L 00000111 11110110
 659. >004613L 01011001 11111111                  BRAX   SRVPT                   (WILL DO MEMPF INDIRECTLY IF NEEDED)
      >004614L 11001111 11111111
 660.                                      .    END FDFCNS;
 661.                                      .
```

FINAL BUFFER OPERATIONS - CRC CHECK & OUTPUT & SPECIAL STUFF

```
                                  *
004615L                           FDTEND
                                  . 11.70 INPUT-VERIFY
                                  . 10.60 OUTPUT
                                  .  6.60 WPI
                                  .  1.35 MOUT          (ALL TO FDTFIN)
                                  .       BEGIN
                                  .       CASE URB .AND. FDMASK OF
                                  .       0, 1, 2, 3:     BEGIN
004615L 00110001 11010001                   TSTIP   ,FDNINV,URI+URB
004616L 01000101 00100000
004617L 11010010 01011111                   BRA     FDEOT,FZ
                                  .            BINDEL (FDRDTA, TEMP);          GET NEXT BYTES FOR INPUTS
                                  .            IF TEMP <> URD
                                  .            THEN EXIT (FDRCRC);             CRC NOT MATCH
                                  .            BINDEL (FDRDTA, TEMP);
                                  .            IF TEMP <> URE
                                  .            THEN EXIT (FDRCRC);             CRC NOT MATCH
004620L 00010001 11110011                   MBUSAW MADR,FCINDT
004621L 01010011 00010000
004622L 11011100 01101101
004623L 00110111 00100110
004624L 01010001 01101000                   BRC     BINDEL,,$+3
004625L 11001111 00101101
004626L 11011111 01001111                   BRA     FDRDTA
004627L 00010000 11000110                   TSTRT   XR,MCRCH
004630L 11010010 01001100                   BRA     FDRCRC,FZ
004631L 01010001 01100011                   BRC     BINDEL,,$+3
004632L 11001111 00101101
004633L 11011111 01001111                   BRA     FDRDTA
004634L 00010000 11000111                   TSTRT   XR,MCRCL
004635L 11010010 01001100                   BRA     FDRCRC,FZ
004636L                           FDTFIX
004636L 01011001 11110100                   BRAX    FDTFIN
004637L 11011111 01110011
                                  .            END;
004640L                           FDEOT
                                  .       4, 5: BEGIN
004640L 01000101 00010000                   TSTIT   ,FDNOT
004641L 11010010 01010001                   BRA     FDEWPIX,FZ
                                  .            BOTINS (URD);                   OUTPUT CRC BYTES
                                  .            BOTINS (URE);
004642L 00010001 11110011                   MBUSAW MADR,FCOUTC
004643L 01010011 10100000
004644L 11011100 01011011
004645L 00110111 00100110
004646L 00010001 11110110                   LDRR    TEMP1,MCRCH
004647L 01101111 11110001
004650L 01010001 01010101                   BRC     BOTINS
004651L 11011111 11111111
004652L 00010001 11110111                   LDRR    TEMP1,MCRCL
004653L 01101111 11110001
```

```
004654L 01010001 01100001                 BRC    BOTINS,,FDTFIX
004655L 11011111 11111111
                                .             END;
                                .         6: EXIT (FDEWPI);
004656L 01011001 11110100       FDEWPIX   BRAX   FDEWPI                 (WRITE THE FINAL POSTAMBLE)
004657L 11011111 10011000
                                .         7:   ;
                                .         END CASE;
                                .         EXIT (FDTFIN)
                                .         END FDTEND;
                                *
004660L                         FDRDTA
                                .         BEGIN
                                .         LUF := 0202 + 0202;
                                .         EXIT (FENDIR)
004660L 01010001 10000010                   LDTI   0202
004661L 01011001 11110100                   BRAX   FENDIR
004662L 11011111 01101111
                                .         END FDRDTA;
                                *
004663L                         FDRCRC
                                .         BEGIN
                                .         LUF := 0300 + 0300;
                                .         EXIT (FENDIR)
004663L 01010001 11000000                   LDTI   0300
004664L 01011001 11110100                   BRAX   FENDIR
004665L 11011111 01101111
                                .         END FDRDTA;
```

```
                                    *
004666L                             HDRERD
                                    . 9.00                            RE-READ HEADER DISABLING ANY PREV. I/O
                                    .      BEGIN
                                    .      MBUS (MADR, FCLEAR, FKRWMF);
                                    .      EXIT (HDREAD)
004666L 00010001 11110011                    MBUS    MADR,FCLEAR,FKRWMF     (NO POINTER FUNNIES CAN HAPPEN NOW)
004667L 01010011 00110000
004670L 11011100 01000111
004671L 00110111 00100110
004672L 01010001 00100000
004673L 00110111 00100111
004674L 00110111 00101001
                                    .      END HDRERD;
004675L                             HDREAD
                                    . 7.95   (OR 4.25 IF OFFLINE)
                                    .      BEGIN                                   SELECT CORRECT DRIVE
                                    .      IF NOT FSONLN IN MBIN (MADR, FCINST)
                                    .      THEN EXIT (FXIDER);
004675L 00010001 11110011                    MBUS    MADR,FCINST
004676L 11011100 01000001
004677L 00110111 00100110
004700L 00110111 00101001
004701L 01010001 00000001                    LDTI    FSONLN
004702L 11011100 00111101                    MBTIN
004703L 00110101 00010101
                                             IFNE    $>9,FXIDER>9
                                             XIF
004704L 11000011 11101101                    BRA     FXIDER,TZ
                                    .
                                    .      MBUS (MADR, FCOSYM, SADUAL>8);          SET THE SYNC WORD
                                    .      MBUS (MADR, FCOSYL, SADUAL);
                                    .      MBUS (MADR, FCOTDP, FPTHDR>1);          SET DISK BUFFER POINTER
004705L 00010001 11110011                    MBUS    MADR,FCOSYM,SADUAL>8      (JF,BR WASTED)
004706L 01010011 01100000
004707L 11011100 00111000
004710L 00110111 00100110
004711L 01010001 11110101
004712L 00110111 00100111
004713L 00110111 00101001
004714L 00010001 11110011                    MBUS    MADR,FCOSYL,SADUAL
004715L 01010011 01110000
004716L 11011100 00110001
004717L 00110111 00100110
004720L 01010001 01111110
004721L 00110111 00100111
004722L 00110111 00101001
004723L 00010001 11110011                    MBUS    MADR,FCOTDP,FPTHDR>1
004724L 01010011 01000000
004725L 11011100 00101010
004726L 00110111 00100110
004727L 01010001 00000000
```

```
     004730L 00110111 00100111
     004731L 00110111 00101001
                                  .       MBUS (MADR, FCOINT, FMINDX+FMTROK+FMTRER);  INTERRUPTS SET
                                  .       MCRC := SACRC;                            INIT CRC
                                  .       MBUS (MADR, FCLEAR, FKMAST+FKLON);   CLEAR INTERRUPTS & TURN LIGHTS ON
                                  .       MBSTAT := HDRCHK;
                                  .       MBUS (MADR, FCRHDR, FPLHDR>1);            READ IN HEADER
     004732L 01010001 00100001              LDRI   MCRCL,SACRC
     004733L 00000111 11110111
     004734L 00010001 11110011              MBUS   MADR,FCOINT,FMINDX+FMTROK+FMTRER
     004735L 01010011 10110000
     004736L 11011100 00100001
     004737L 00110111 00100110
     004740L 01010001 00001101
     004741L 00110111 00100111
     004742L 00110111 00101001
     004743L 01010001 11101111              LDRI   MCRCH,SACRC>8
     004744L 00000111 11110110
     004745L 00010001 11110011              MBUS   MADR,FCLEAR,FKMAST+FKLON
     004746L 01010011 00110000
     004747L 11011100 00011000
     004750L 00110111 00100110
     004751L 01010001 10111111
     004752L 00110111 00100111
     004753L 00110111 00101001
     004754L 01010001 10111000              BAL    MBSTAT,HDRCHK
     004755L 00000111 11110101
     004756L 00010001 11110011              MBUS   MADR,FCRHDR,FPLHDR>1
     004757L 01010011 11000000
     004760L 11011100 00001111
     004761L 00110111 00100110
     004762L 01010001 00000111
     004763L 00110111 00100111
     004764L 00110111 00101001
                                  .       RETURN (SRVBSN)
    >004765L 01011001 11111111              BRAX   SRVBSN
    >004766L 11001111 11111111
                                  .       END HDREAD;
                                  .
     004767L 11111111 11111111              TABPAGE FLEXL
     004770L 11111111 11111111
     004771L 11111111 11111111
     004772L 11111111 11111111
     004773L 11111111 11111111
     004774L 11111111 11111111
     004775L 11111111 11111111
     004776L 11111111 11111111
     004777L 11111111 11111111
```

```
                              *
005000L                       HDROK
                              .      MBUS (MADR, FCOINT, FMTROK + FMTRER + FMINDX);  IT WAS, IT WAS!
                              .      MBSTAT := DONIO;                         WHAT KIND OF ACTION?
                              .      MBUS (MADR, FCLEAR, FKMAST + FKLON);     READY - LIGHTS
005000L 00010001 11110011              MBUS   MADR,FCOINT,FMTROK+FMTRER+FMINDX     (JF,BR WASTED)
005001L 01010011 10110000
005002L 11001100 11111101
005003L 00110111 00100110
005004L 01010001 00001101
005005L 00110111 00100111
005006L 00110111 00101001
005007L 01010001 11101011              BAL    MBSTAT,DONIO
005010L 00000111 11110101
005011L 00010001 11110011              MBUS   MADR,FCLEAR,FKMAST+FKLON
005012L 01010011 00110000
005013L 11001100 11110100
005014L 00110111 00100110
005015L 01010001 10111111
005016L 00110111 00100111
005017L 00110111 00101001
                              .      IF FFREAD IN MBITS
                              .      THEN EXIT (DOREAD)                       READ IF THAT WHAT WANTED
                              .      ELSE IF FFWRITE IN MBITS
                              .           THEN EXIT (DOWRITE)                 WRITE IF THAT WHAT WANTED
                              .           ELSE IF FFWDCG IN MBITS
                              .                THEN EXIT (DOWDCG)             DO D.C. GAP SIMILARLY
                              .                ELSE EXIT (HDREAD)             DOES NOTHING EXCEPT
                              .                                               SYNC INDEX PULSES
005020L 00010001 11110100              TSTIR  ,FFRMSK,MBITS
005021L 01000101 00100000
005022L 11000010 10100011              BRA    DOWRITE,FZ
                              .        BRA    DOREAD
                              .      END FXIO;
                              *
005023L                       DOREAD
                              ** 25.75 **
                              .    +   0.40 IF SECTOR ZERO - 0.10 IF DELETED DATA + 3.05 IF DOUBLE DENSITY
                              .      BEGIN
                              .      IF FFDBL IN MBITS                        DOUBLE DENSITY?
005023L 01000101 00001000              TSTIT  ,FFDBL
005024L 11000011 11011001              BRA    RDSGL,TZ
                              .      THEN BEGIN
                              .           MBUS (MADR, FCOTUP, FPTRDTA>1);     MUST DO SPECIAL CHECK
                              .           MBUS (MADR, FCOINT, FMINDX+FMTROK+FMTRER+FMPNTR);
                              .           MBSTAT := DBLRED
005025L 00010001 11110011              MBUS   MADR,FCOTUP,FPTRDTA>1  (DON'T WANT DATA, JUST INTERRUPT)
005026L 01010011 01010000
005027L 11001100 11101000
005030L 00110111 00100110
005031L 01010001 00111111
005032L 00110111 00100111
```

START TO PERFORM THE ACTUAL DATA READ OR WRITE OPERATION

```
005033L 00110111 00101001
005034L 00010001 11110011                MBUS   MADR,FCOINT,FMINDX+FMTROK+FMTRER+FMPNTR
005035L 01010011 10110000
005036L 11001100 11100001
005037L 00110111 00100110
005040L 01010001 00011101
005041L 00110111 00100111
005042L 00110111 00101001
005043L 01010001 11010100                BAL    MBSTAT,DBLRED
005044L 00000111 11110101
005045L 00010001 11110100                LDTR   MBITS                        (RELOAD BITS TO TEST)
                                .            END;
005046L                         RDSGL
                                .       IF FFRDLTD IN MBITS                          DELETED DATA SECTOR?
005046L 01000101 00010000                TSTIT  ,FFRDLTD
005047L 11000011 11001000                BRA    RDNORM,TZ
                                .       THEN BEGIN
                                .            MBUS (MADR, FCOSYM, SMDUAL>8);          YES, LOOK FOR IT
                                .            MBUS (MADR, FCOSYL, SMDUAL)
005050L 00010001 11110011                MBUS   MADR,FCOSYM,SMDUAL>8
005051L 01010011 01100000
005052L 11001100 11010101
005053L 00110111 00100110
005054L 01010001 11110101
005055L 00110111 00100111
005056L 00110111 00101001
005057L 00010001 11110011                MBUS   MADR,FCOSYL,SMDUAL
005060L 01010011 01110000
005061L 11001100 11001110
005062L 00110111 00100110
005063L 01010001 01101010
005064L 00110111 00100111
005065L 00110111 00101001
005066L 11001111 10111010                BRA    RDDLTD
                                .            END
                                .       ELSE BEGIN
005067L                         RDNORM
                                .            MBUS (MADR, FCOSYM, SDDUAL>8);          NO, NORMAL DATA
                                .            MBUS (MADR, FCOSYL, SDDUAL)
005067L 00010001 11110011                MBUS   MADR,FCOSYM,SDDUAL>8
005070L 01010011 01100000
005071L 11001100 11000110
005072L 00110111 00100110
005073L 01010001 11110101
005074L 00110111 00100111
005075L 00110111 00101001
005076L 00010001 11110011                MBUS   MADR,FCOSYL,SDDUAL
005077L 01010011 01110000
005100L 11001100 10111111
005101L 00110111 00100110
005102L 01010001 01101111
005103L 00110111 00100111
```

START TO PERFORM THE ACTUAL DATA READ OR WRITE OPERATION

```
        005104L 00110111 00101001
  828.                                 .            END;
  829,  005105L                        RDDLTD
  830,                                 .      MBUS (MADR, FCOTOP, FPTRDTA>1);          POINT TO INPUT BUFFER
  831,                                 .      MBUS (MADR, FCLEAR, FKMAST);             CLEAR PNTR INTERRUPT THAT SET
  832,                                 .      MBUS (MADR, FCRTIM, FPLRDTA>1);          READ - IF NOT TOO LATE
  833,                                 .      RETURN (SRVBSN)
  834.  005105L 00010001 11110011                MBUS   MADR,FCOTOP,FPTRDTA>1
        005106L 01010011 01000000
        005107L 11001100 10111000
        005110L 00110111 00100110
        005111L 01010001 00111111
        005112L 00110111 00100111
        005113L 00110111 00101001
  835.  005114L 00010001 11110011                MBUS   MADR,FCLEAR,FKMAST
        005115L 01010011 00110000
        005116L 11001100 10110001
        005117L 00110111 00100110
        005120L 01010001 00111111
        005121L 00110111 00100111
        005122L 00110111 00101001
  836.  005123L 00010001 11110011                MBUS   MADR,FCRTIM,FPLRDTA>1
        005124L 01010011 11010000
        005125L 11001100 10101010
        005126L 00110111 00100110
        005127L 01010001 10000011
        005130L 00110111 00100111
        005131L 00110111 00101001
  837. >005132L 01011001 11111111                BRAX   SRVBSN
       >005133L 11001111 11111111
  838.                                 .      END DOREAD;
```

```
                                  +
                                  *
 005134L                          DOWRITE
 005134L 01000101 00010000                 TSTIT   ,FFWMSK
 005135L 11000010 01110000                 BRA     DOWDCG,FZ
                                  .        BRA     DOWRITE
                                  . 24.05 + 0.10 IF WRITE DOUBLE DENSITY  (FROM HDRCRC)
                                  .      BEGIN
                                  .      MBUS (MADR, FCOMOD,
                                  .           ((FO43MGC + MDSKT) .AND. FO43MSK) +
                                  .           ((MBITS .AND. FRDRV) + FODR0)));    SET CORRECT BIAS CURRENT
                                  .
 005136L 01010001 01010100                 DOTRI   ,AC,MDSKT,FO43MGC,C0    BIT 6 <= 43 & BIT 7 > 43
 005137L 00010010 00111001
 005140L 01010101 11000000                 DORI    TEMP1,ND,FO43MSK
 005141L 01101111 11110001
 005142L 00010001 11110100                 DOTIR   ,ND,FRDRV,MBITS
 005143L 01010101 00000001
 005144L 11001100 10011011                 MBWAIT
 005145L 01110010 01110001                 DOPR    MIFDAT,AC,TEMP1,,C1     (C1 TO ADD FODR0)
 005146L 00110111 00100111
 005147L 00010001 11110011                 MBUS    MADR,FCOMOD             (JF,BR WASTED)
 005150L 01010011 10010000
 005151L 11001100 10010110
 005152L 00110111 00100110
 005153L 00110111 00101001
                                  .      IF FFSGL IN MBITS                               SINGLE DENSITY?
 005154L 00010001 11110100                 TSTIR   ,FFDBL,MBITS
 005155L 01000101 00001000
 005156L 11000010 10000000                 BRA     WDBL,FZ
                                  .      THEN BEGIN
                                  .           MBUS (MADR, FCOTDP, FPTWSGL>1);        WAS SINGLE, DO IT!
                                  .           MBUS (MADR, FCWRTN, FPLWSGL>1)
 005157L 00010001 11110011                 MBUS    MADR,FCOTDP,FPTWSGL>1
 005160L 01010011 01000000
 005161L 11001100 10001110
 005162L 00110111 00100110
 005163L 01010001 00110111
 005164L 00110111 00100111
 005165L 00110111 00101001
 005166L 00010001 11110011                 MBUS    MADR,FCWRTN,FPLWSGL>1
 005167L 01010011 11100000
 005170L 11001100 10000111
 005171L 00110111 00100110
 005172L 01010001 10001100
 005173L 00110111 00100111
 005174L 00110111 00101001
>005175L 01011001 11111111                 BRAX    SRVBSN
>005176L 11001111 11111111
                                  .           END
                                  .      ELSE BEGIN
 005177L                          WDBL
```

```
869.                                .           MBUS (MADR, FCOTDP, FPTWDBL>1);     WAS DOUBLE, DO IT!
870.                                .           MBUS (MADR, FCWDGP, FPLWDBL>1)
871.  005177L 00010001 11110011              MBUS   MADR,FCOTDP,FPTWDBL>1
      005200L 01010011 01000000
      005201L 11001100 01111110
      005202L 00110111 00100110
      005203L 01010001 00111001
      005204L 00110111 00100111
      005205L 00110111 00101001
872.  005206L 00010001 11110011              MBUS   MADR,FCWDGP,FPLWDBL>1
      005207L 01010011 11110000
      005210L 11001100 01110111
      005211L 00110111 00100110
      005212L 01010001 10001010
      005213L 00110111 00100111
      005214L 00110111 00101001
873. >005215L 01011001 11111111              BRAX   SRVBSN
     >005216L 11001111 11111111
874.                                .           END;
875.                                .       RETURN (SRVBSN)
876.                                .       END DOWRITE;
877.                                *
878.  005217L                       DOWDCG
879.  005217L 11001100 01110000              MBWAIT
880.  005220L 01011001 11110110              BPGX   HDREAD
881.  005221L 01000101 00001000              TSTIT  ,FFSMSK
882.  005222L 11010010 01000010              BRA    HDREAD,FZ                       SYNC IS: READ NEXT HEADER
883.                                .        BRA    DOWDCG
884.                                .                                               WRITE D.C. GAP
885.                                .       BEGIN
886.                                .       MBUS (MADR, FCWDCG);                    DO IT!
887.                                .       RETURN (SRVBSN)
888.  005223L 00010001 11110011              MBUSAS MADR,FCWDCG            (DOES NO MWAIT'S ELSE PROBLEMS)
      005224L 01010011 10000000
      005225L 00110111 00100110
      005226L 00110111 00101001
889. >005227L 01011001 11111111              BRAX   SRVBSN
     >005230L 11001111 11111111
890.                                .       END DOWDCG;
```

```
                                   *
005231L                            FXIO:
                                   , 19,60 - FDCMD
                                   .       - FDDATA DOCUMENTED THROUGH THE CODE
                                   .
                                   .         BEGIN
                                   .         IF SWUSER IN PSW                           ONLY IF PRIV'D
                                   .         THEN EXIT (IVIOL$);
005231L 00110001 11011100                      TSTIP   ,SWUSER,PSWI
005232L 01000101 00000100
005233L 11010010 00101001                      BRA     IVIOL5,FZ
                                   .         IF NOT ZERO IMP
005234L 11001001 00111100                      BRA     FDATA,T0,IZ
                                   .         THEN BEGIN                                 DO 111 141 INSTRUCTION
                                   .             IF FRBUSY IN MBITS                     AND NOT DOING ANYTHING ELSE
                                   .             THEN EXIT (NOTYET);
005235L 00010001 11110100                      TSTIR   ,FRBUSY,MBITS
005236L 01000101 00000010
005237L 11000010 00011101                      BRA     NOTYET,FZ
                                   .             PC := MAR + 1;                         CORRECT PC FOR SPECIAL EXIT
005240L 00110111 00001100                      STB     IMAR
005241L 00110001 10001001                      DLDX    MR2PC
005242L 00110001 10101000
                                   .             MTRAK := URD;                          GET TRACK NUMBER
                                   .             MSECT := URE;                          GET SECTOR NUMBER
                                   .             MADR := URA .AND. 017;                 GET ADDRESS OF DEVICE
                                               IFC     APF
                                               XIF
                                               IFS     APF
005243L 01010001 01100111                      DLDPI   MARO,SVMTRAK
005244L 00110111 11000000
005245L 01010001 11101111
005246L 00110111 11100000
005247L 00110001 11010011                      LDPP    MDW,URI+URD
005250L 00110111 00100001
                                               XIF
005251L 00110001 11010000                      DORIP   MADR,ND,017,URI+URA,CC
005252L 01010101 00001111
005253L 00000111 10110011
                                   .             MBITS := (URC .AND. 1) .XOR. (FRBUSY + FRDR0)
                                   .                    + (URB .AND. FFMASK);             GET DRIVE AND FUNCTION
                                   .             IF FFSYNC IN URB                         IF JUST WANT INDEX SYNC
                                   .             THEN MBITS := MBITS .OR. (FRIXCT +  FRIXCX);   SET TO THIRD REV
005254L 00110001 11010010                      DOTIP   ,ND,FRDRV,URI+URC
005255L 01010101 00000001
005256L 01010000 00000011                      DORI    MBITS,XR,FRBUSY+FDDR0,,CC
005257L 00000111 10110100
005260L 00110001 11010001                      DOTIP   ,ND,FFMASK,URI+URB
005261L 01010101 00111000
005262L 01000000 00111000                      TSTIT   XR,FFSYNC
005263L 11000010 01001010                      BRA     FXIO1,FZ
005264L 01010011 11000000                      DOTI    ,OR,FRIXCT+FRIXCX
```

```
005265L                             FXIO1
005265L 00010011 11110100                      DORR     MBITS,OR,MBITS
005266L 00000111 11110100
                                    .              MBSTAT := HDRERD;                          ENTER THROUGH FRONT DOOR
                                    .              IAKCODE := 0;                              AS IF GOT INTERRUPT
                                    .                                                         DONE FOR INITIAL DRIVE SELECT
                                    .              IMP := FLAGS := 0;                         MARK START TO DO IT
                                    .              EXIT (MBSTRT)                              GO READ FIRST HEADER
005267L 01010001 11101110                      BAL      MBSTAT,HDSTRT,CC            (STATE IS TO RE-DO HEADER READ)
005270L 00000111 10110101
                                               IFS      APF
005271L 11000100 01000110                      MWAIT    ,MEMPF5
005272L 11010111 00010110
005273L 00110111 00001101                      STB      DMAR                        (WRITE DESIRED SECTOR # IN MEMORY)
005274L 00110001 11010100                      LDPP     MDW,URI+URE
005275L 00110111 00100001

                                               XIF
005276L 01010001 00000000                      LDPI     LIMP,0                      (T-REG MUST BE 0 AT MBSTRT)
005277L 00110111 00000001
005300L 00110111 00000110                      LDPT     LUF
005301L 01011001 11110111                      BRAX     MBSTRT                      (ENTERS WITH IAKODE OF ZERO)
005302L 11001111 11111111
                                    . 4.15 (NO FETCH)
                                    .              END
                                    *
                                    .        ELSE BEGIN
                                    .              IF URB <> FDOUT
                                    .              THEN BEGIN
                                    .                    IF FRBUSY IN MBITS
                                    .                    THEN EXIT (NOTYET);
                                    .                    MADR := URA .AND. 017;
                                    .                    END;
                                               IFS      APF
005303L                             FDATA
                                    . 4.15 - STARTUP - .55 IF 070 - OUT
005303L 00110001 11010001                      DOTIP    ,ND,FFMASK,URI+URB
005304L 01010101 00111000
005305L 01000000 00111000                      TSTIT    XR,FDOUT
005306L 11000011 00110101                      BRA      FDATA1,TZ
                                               XIF
                                               IFC      APF
                                               XIF
005307L 00010001 11110100                      TSTIR    ,FRBUSY,MBITS
005310L 01000101 00000010
005311L 11000010 00011101                      BRA      NOTYET,FZ
005312L                             FDATA1
                                    .              MAR := URDE;                               SAVE THE REGISTERS
                                    .              URDE := MCRC;
                                    .              MCRC := MAR;
                                    .              MAR := URHL;
                                    .              URH := MBSTAT;
```

```
                            .          URL := MADR;
005312L 00110001 11000100           DLDX   DE2MR
005313L 00110001 11100011
005314L 00010001 11110111           DLDPR  URO+UDE,MCRC
005315L 00110111 10000100
005316L 00010001 11110110
005317L 00110111 10000011
005320L 00110001 10010000           DLDRP  MCRC,MARI
005321L 00000111 11110111
005322L 00110001 10110000
005323L 00000111 11110110
005324L 00110001 11000110           DLDX   HL2MR
005325L 00110001 11100101
005326L 00010001 11110011           LDPR   URO+URL,MADR
005327L 00110111 10000110
005330L 00010001 10110101           LDPR   URO+URH,MBSTAT,,CC     (SAVE MBSTAT FOR INTERRUPT ROUTINE)
005331L 00110111 10000101
005332L 00110001 11010000           DORIP  MADR,ND,017,URI+URA
005333L 01010101 00001111
005334L 00000111 11110011
                            .          CASE URB .AND. FDSMSK OF          141 - FDATA INSTRUCTION
005335L 00110001 11010001           DOTIP  ,ND,FDSMSK,URI+URB
005336L 01010101 00000011
005337L 01010010 00010101           DORA   LINK,AC,FDTBL,,CC      (CC FOR FDTFCN AT LEAST)
005340L 01101111 10110000
005341L 11101111 00000000           BRR    LINK
                            .          3:   EXIT (FDTFIN);
                            .          2:   EXIT (FDTEND);
                            .          1:   EXIT (FDTFCN);
                            .          0:   EXIT (FDINIT);
                            .          END CASE
                            .
                            *
005342L                     NOTYET
                            . 3.95 INCL IFETCH
                            .      LUF := 0200 + 0200;              ERRORS, DID NOTHING
                            .      EXIT (FENDIT)
005342L 01010001 10000000            LDRI   TEMP1,0200
005343L 01101111 11110001
005344L 11011111 01011110            BRA    FENDIT
                            .      END NOTYET;                      CARRY TRUE, ZERO TRUE
```

```
                                   *
005345L                            FDTENX
005345L 01011001 11110110                    BRAX   FDTEND
005346L 11011111 01110010
                                   * (TABLE NOT TOTALED IN TIMING)
005347L 11011111 01110011                    BRA    FDTFIN
005350L 11001111 00011010                    BRA    FDTENX
005351L 11011111 10100101                    BRA    FDTFCN
005352L                            FDTBL
                                   .         BRA    FDINIT
                                   .      END FXIO;
```

```
                                              +
                                              *
     005352L                                  FDINIT
                                              . 7.65 +.10 IF DLTD (00,10,20,30), 7.20 (40,50), 11.30 (60), .70 (70)
                                              .        BEGIN
                                              .        URB := URB .OR. 1;                      MARK FOR FDATAFCN STATE
                                              .        IF URB = FDOUT .OR. 1                   MOUT OPERATION?
                                              .        THEN EXIT (FDTFCN);
     005352L 00110001 11010001                           DOPIP   URO+URB,OR,1,URT+URB
     005353L 01010011 00000001
     005354L 00110111 10000001
     005355L 01000000 00111001                           TSTIT   XR,FDOUT+1
     005356L 11010011 10100101                           BRA     FDTFCN,TZ
                                              .        IF URB = FDWPI .OR. 1                   PREAMBLE INITIALIZE??
                                              .        THEN BEGIN
     005357L 01000000 00110001                           TSTIT   XR,FDWPI+1
     005360L 11010010 11110010                           BRA     FDREG,FZ
                                              .             MBUS (MADR, FCOTUP, FPTWSGL>1);    POINT TO INIT AREA
                                              .             URC := 12;                         12  BYTES IN SYNC AREA
     005361L 00010001 11110011                           MBUS    MADR,FCOTUP,FPTWSGL>1
     005362L 01010011 01010000
     005363L 11001100 00001100
     005364L 00110111 00100110
     005365L 01010001 00110111
     005366L 00110111 00100111
     005367L 00110111 00101001
     005370L 01010001 00001100                           LDPI    URO+URC,12
     005371L 00110111 10000010
                                              .             FOR I = 1 TO 4
                                              .             DO   MBUS (MADR, FCOUTC, 0377);    INIT D.C. GAP AREA
     005372L 01010001 11111100                           LDRI    TEMP1,-4
     005373L 01101111 11110001
     005374L                                  FDTINI
                                                         RPT     5                     (DELAY FOR 2 MICRO-SECONDS)
     005374L 11001111 00000010                           BRA     $+1                   (BETWEEN BUFFER WRITES)
     005375L 11001111 00000001                           BRA     $+1                   (BETWEEN BUFFER WRITES)
     005376L 11001111 00000000                           BRA     $+1                   (BETWEEN BUFFER WRITES)
     005377L 11011111 11111111                           BRA     $+1                   (BETWEEN BUFFER WRITES)
     005400L 11011111 11111110                           BRA     $+1                   (BETWEEN BUFFER WRITES)
     005401L 00010001 11110011                           MBUS    MADR,FCOUTC,0377
     005402L 01010011 10100000
     005403L 11011100 11111100
     005404L 00110111 00100110
     005405L 01010001 11111111
     005406L 00110111 00100111
     005407L 00110111 00101001
     005410L 01110001 11110001                           INCR    TEMP1,TEMP1
     005411L 01101110 01110001
     005412L 11000010 00000011                           BRA     FDTINI,FZ
                                              .             EXIT (FDTFCN)
     005413L 00010111 10110010                           CCLR
     005414L 11011111 10100101                           BRA     FDTFCN
```

```
                                  .          END;
005415L                           FDREG
                                  .       IF FDDBL IN URB
                                  .       THEN URC := 0      256 ;              256 DATA BYTES
                                  .       ELSE URC := 128;                      128 DATA BYTES
005415L 01010101 00001000                   TSTIT   ND,FDDBL,,,TW
005416L 11010010 11101111                   BRA     FDRDBL,FZ
005417L 01010001 10000000                   LDTI    128
005420L                           FDRDBL
005420L 01010101 10000000                   DOPI    URO+URC,ND,128
005421L 00110111 10000010
                                  .       MBUS (MADR, FCOTUP, FPTRDTA>1);       POINT TO SYNC BYTES
005422L 00010001 11110011                   MBUS    MADR,FCOTUP,FPTRDTA>1
005423L 01010011 01010000
005424L 11011100 11101011
005425L 00110111 00100110
005426L 01010001 00111111
005427L 00110111 00100111
005430L 00110111 00101001
                                  .       IF FDLTD IN URB
                                  .       THEN BEGIN
                                  .            URDE := SMCRC;                   INIT CRC FOR DELETED DATA
                                  .            TEMP := SMDUAL                   INIT SYNC BYTES ALSO
                                  .            END
                                  .       ELSE BEGIN
                                  .            URDE := SDCRC;                   INIT CRC FOR NORMAL DATA
                                  .            TEMP := SDDUAL                   INIT SYNC BYTES ALSO
                                  .            END;
005431L 00110001 11010001                   TSTIP   ,FDLTD,URI+URB
005432L 01000101 00000100
005433L 11010011 11011011                   BRA     FDTNRM,TZ
005434L 01010001 11100111                   DLDRI   MCRC,SMCRC
005435L 00000111 11110111
005436L 01010001 10001111
005437L 00000111 11110110
005440L 01010001 01101010                   LDRI    TEMPL,SMDUAL
005441L 01101111 11110010
005442L 01010001 11110101                   LDTI    SMDUAL>8
005443L 11011111 11010100                   BRA     FDTLTD
005444L                           FDTNRM
005444L 01010001 10000100                   DLDRI   MCRC,SDCRC
005445L 00000111 11110111
005446L 01010001 10111111
005447L 00000111 11110110
005450L 01010001 01101111                   LDRI    TEMPL,SDDUAL
005451L 01101111 11110010
005452L 01010001 11110101                   LDTI    SDDUAL>8
005453L                           FDTLTD
005453L 01101111 11110001                   LDRT    TEMPH
                                  .       IF FDOUT IN URB
005454L 00110001 11010001                   TSTIP   ,FDNINV,URI+URB
005455L 01000101 00100000
```

```
 1083  005456L 11010011 10111010           BRA   FDTINVR,TZ
 1084                              .       THEN BEGIN
 1085                              .           MBUS (MADR, FCOUTC, TEMPH);          OUTPUT SYNC BYTE MSB
 1086                              .           MBUS (MADR, FCOUTC, TEMPL)           AND SYNC LSB
 1087  005457L 00010001 11110011           MBUS  MADR,FCOUTC,,TEMPH
       005460L 01010011 10100000
       005461L 11011100 11001110
       005462L 00110111 00100110
       005463L 01110001 11110001
       005464L 00110111 00100111
       005465L 00110111 00101001
 1088                                      RPT   7                        (2 MICRO-SECOND DELAY NEEDED)
 1089  005466L 11011111 11001000           BRA   $+1
 1089  005467L 11011111 11000111           BRA   $+1
 1089  005470L 11011111 11000110           BRA   $+1
 1089  005471L 11011111 11000101           BRA   $+1
 1089  005472L 11011111 11000100           BRA   $+1
 1089  005473L 11011111 11000011           BRA   $+1
 1089  005474L 11011111 11000010           BRA   $+1
 1090  005475L 00010001 10110011           MBUS  MADR,FCOUTC,,TEMPL,CC
       005476L 01010011 10100000
       005477L 11011100 11000000
       005500L 00110111 00100110
       005501L 01110001 10110010
       005502L 00110111 00100111
       005503L 00110111 00101001
 1091  005504L 11011111 10100101           BRA   FDTFCN
 1092                              .           END
 1093                              .       ELSE BEGIN
 1094                              .           IF MBIN (MADR, FCINDT) <> TEMPH      MAKE SURE CORRECT SYNC BYTE
 1095                              .           THEN EXIT (FDRDT5X);
 1096                              .           IF MBIN (MADR, FCINDT) <> TEMPL      MAKE SURE CORRECT SYNC BYTE
 1097                              .           THEN EXIT (FDRDT5X)
 1098  005505L                     FDTINVR
 1099  005505L 00010001 11110011           MBUS  MADR,FCINDT
       005506L 01010011 00010000
       005507L 11011100 10111000
       005510L 00110111 00100110
       005511L 00110111 00101001
 1100  005512L 01110001 11110001           LDTR  TEMPH
 1101  005513L 11011100 10110100           MBTIN XR
       005514L 00110000 00010101
 1102  005515L 11010010 10011010           BRA   FDRSYNC,FZ
 1103                                      RPT   7
 1104  005516L 11011111 10110000           BRA   $+1
 1104  005517L 11011111 10101111           BRA   $+1
 1104  005520L 11011111 10101110           BRA   $+1
 1104  005521L 11011111 10101101           BRA   $+1
 1104  005522L 11011111 10101100           BRA   $+1
 1104  005523L 11011111 10101011           BRA   $+1
 1104  005524L 11011111 10101010           BRA   $+1
 1105  005525L 00110111 00101001           STB   MIFSTB
```

```
1106.  005526L 01110001 10110010                 LDTR   TEMPL,CC
1107.  005527L 11011100 10101000                 MBTIN  XR
       005530L 00110000 00010101
1108.  005531L 11010010 10011010                 BRA    FDRSYNC,FZ
1109.                                  .         BRA    FDTFCN
1110.                                  .            END;
1111.                                  *
1112.                                  .       EXIT (FDTFCN)                       OK, GO DO MAIN WORK
1113.                                  .       END FDINIT;
```

```
                                     +
                                     *
005532L                              FDTFCN
                                     . 1.50
                                     .      BEGIN
005532L 00110111 01000111                     STB    SMR                  (EVEN IF NOT NEEDED)
                                     .      MBSTAT := CASE URB .AND. FDMASK OF        SET UP LOOP ROUTINE
                                     .          (INS, IND, VRS, VRO, OTS, OTD, WPI, OUT);
                                     .      EXIT (MBSTAT)
005533L 00110001 11010001                     DOTIP  ,ND,FDMASK,URT+URB
005534L 01010101 00111000
005535L 01010010 10100110                     DORA   MBSTAT,AC,FDFTBL
005536L 00000111 11110101
005537L 11011100 10100000                     MBWAIT
005540L 00010001 10110011                     LDTR   MADR,CC              (CC IS FOR FDWPI, FDF)
005541L 11010100 10011110                     MWAIT  ,IGNORE
005542L 01011001 11110110                     BPGX   FDFTBL               (POINT TO PAGE 4 SO CAN)
005543L 11010111 10000110                     BRA    MEMPF4,T0,MP         (RESTORE REGS BEFORE MEMORY FAULT)
005544L 10001111 00000101                     BRR    MBSTAT
                                     .      END FDTFCN;
                                     .
                                     .      END FENDIT;
                                     *
005545L                              FDRSYNC
                                     . 5.80 INCL IFETCH
                                     .      BEGIN
                                     .      LUF := 0202 + 0202;            ERROR, BAD SYNC BYTES
                                     .      EXIT (FENDIR)
005545L 01010001 10000010                     LDTI   0202
005546L 11011111 01101111                     BRA    FENDIR
                                     .      END FDRSYNC;                   CARRY TRUE, ZERO-SIGN FALSE
                                     *
005547L                              FDEWPI
                                     .      6:  BEGIN
005547L 01000000 00110010                     TSTIT  XR,FDWPI+2
005550L 11010010 01110011                     BRA    FDTFIN,FZ
                                     .          MBUS (MADR, FCOTUP, FPTWSGL + FPLWSGL>1);  POINT TO POSTAMBLE
                                     .          MBUS (MADR, FCOUTC, SOCLK);        PUT OUT POST BYTES ALSO
                                     .          MBUS (MADR, FCOUTC, SOCLK);
005551L 00010001 11110011                     MBUS   MADR,FCOTUP,FPTWSGL+FPLWSGL-2>1
005552L 01010011 01010000
005553L 11011100 10010100
005554L 00110111 00100110
005555L 01010001 11000010
005556L 00110111 00100111
005557L 00110111 00101001
                                              RPT    7                    (2 MICRO-SECOND DELAY)
005560L 11011111 10001110                     BRA    $+1
005561L 11011111 10001101                     BRA    $+1
005562L 11011111 10001100                     BRA    $+1
005563L 11011111 10001011                     BRA    $+1
005564L 11011111 10001010                     BRA    $+1
```

```
005565L 11011111 10001001                    BRA     $+1
005566L 11011111 10001000                    BRA     $+1
005567L 00010001 11110011                    MBUS    MADR,FCOUTC,SOCLK
005570L 01010011 10100000
005571L 11011100 10000110
005572L 00110111 00100110
005573L 01010001 10101010
005574L 00110111 00100111
005575L 00110111 00101001
                                             RPT     7                        (2 MICRO-SECOND DELAY)
005576L 11011111 10000000                    BRA     $+1
005577L 11011111 01111111                    BRA     $+1
005600L 11011111 01111110                    BRA     $+1
005601L 11011111 01111101                    BRA     $+1
005602L 11011111 01111100                    BRA     $+1
005603L 11011111 01111011                    BRA     $+1
005604L 11011111 01111010                    BRA     $+1
005605L 00010001 11110011                    MBUS    MADR,FCOUTC,SOCLK
005606L 01010011 10100000
005607L 11011100 01111000
005610L 00110111 00100110
005611L 01010001 10101010
005612L 00110111 00100111
005613L 00110111 00101001
                                   .         BRA     FDTFIN
                                   .            END;
                                   *
005614L                            FDTFIN
                                   . 6.00 INCL IFETCH
                                   .       BEGIN
                                   .       URB := URB .OR. 3;                    MARK THE END
                                   .       LUF := 0 + 0;                         WITHOUT ERRORS
                                   .       EXIT (FENDIR)
005614L 00110001 11010001                    DOPIP  URO+URB,OR,3,URI+URB
005615L 01010011 00000011
005616L 00110111 10000001
005617L 01010001 00000000                    TCLR
                                   .         BRA    FENDIR
                                   .       END FDTFIN;                           CARRY FALSE
                                   *
005620L                            FENDIR
                                   . 5.50 INCL IFETCH
                                   .       BEGIN
                                   .       MBSTAT := URH;
                                   .       MADR := URL;
                                   .       HL := MAR;
                                   .       MAR := DE;
                                   .       DE := MCRC;                           RESTORED REGISTERS
                                   .       MCRC := MAR;
                                   .       EXIT (FENDIT)
005620L 01101111 11110001                    LDRT   TEMP1
005621L 00110001 11010101                    LDRP   MBSTAT,URI+URH
```

```
 005622L 00000111 11110101
 005623L 00110001 11010110              LDRP   MADR,URI+URL
 005624L 00000111 11110011
 005625L 00110001 10000110              DLDX   MR2HL
 005626L 00110001 10100101
 005627L 00110001 11000100              DLDX   DE2MR                   (AS TEMPORARY HOLDING REG)
 005630L 00110001 11100011
 005631L 00010001 11110111              DLDPR  URO+UDE,MCRC
 005632L 00110111 10000100
 005633L 00010001 11110110
 005634L 00110111 10000011
 005635L 00110001 10010000              DLDRP  MCRC,MARI
 005636L 00000111 11110111
 005637L 00110001 10110000
 005640L 00000111 11110110
                              .         BRA    FENDIT
                              .       END FENDIR;
                              *
 005641L                      FENDIT
                              . 3.55 INCL. IFETCH
                              .       BEGIN
                              .       MODW := PSW := PSW .AND. -1-SWRPT;        DISABLE REPEAT STATUS
                              .       RETURN (FETCH)
 005641L 01110001 11110001              DOPRR  LUF,AC,TEMP1,TEMP1,C0  (DONE NOW WITH COMMON CODE)
 005642L 01110010 00110001
 005643L 00110111 00000110
 005644L 00110001 11011100              DOPIP  PSWO,ND,-1-SWRPT,PSWI
 005645L 01010101 11011111
 005646L 00110111 10001100
 005647L 00110111 00000100              LDPT   MODW
>005650L 01011001 11111111              BRAX   FETCH
>005651L 11001111 11111111
                              .
```

```
                                     *
 005652L                             FXSTAT:
                                     . 3,45 - FXSTAT
                                     . 5.85 - FXSCLR
                                     .
                                     .      BEGIN
                                     .      IF SWUSER IN PSW                          ONLY ALLOW IF PRIVED
                                     .      THEN EXIT (IVIOL$);
 005652L 00110001 11011100                    TSTIP   ,SWUSER,PSWI
 005653L 01000101 00000100
 005654L 11010010 00101001                    BRA     IVIOL5,FZ
                                     .      URA := MBITS;                             GIVE USER STATUS OF I/O
                                     .      URD := MDSKT;                             TRACK NUMBER
                                     .      URE := MDSKS;                             SECTOR NUMBER
 005655L 00010001 11110100                    LDPR    URO+URA,MBITS
 005656L 00110111 10000000
 005657L 00010001 11111001                    LDPR    URO+URD,MDSKT
 005660L 00110111 10000011
 005661L 00010001 11111000                    LDPR    URO+URE,MDSKS
 005662L 00110111 10000100
                                     .      IF NOT ZERO IMP
>005663L 01011001 11111111                    BRAX    FETCHI,T@,IZ
>005664L 11001001 11111111
                                     .      THEN BEGIN                                FXSCLR
                                     .           MBITS := 0;
                                     .           MBSTAT := NOTHINGTODO
 005665L 01010001 00000000                    BAL     MBSTAT,-1             (LOADS T-REG WITH ZERO)
 005666L 00000111 11110101
 005667L 00000111 11110100                    LDRT    MBITS
>005670L 11001111 11111111                    BRA     FETCHI
                                     .           END
                                     .      ELSE RETURN (FETCHI)
                                     .      END FXSTAT;
                                     .
 1234.                                  *
 1235.  005671L                         UBIO:
 1236.                                  . 3,85   UBOUT
 1237.                                  . 6,40   UBIN
 1238.                                  . 5,95   UBOUT2
 1239.                                  . 6,60   UBIN2
 1240.                                  .
 1241.                                  .      BEGIN
 1242.                                  .      IF SWUSER IN PSW                        ONLY IS PRIV'D
 1243.                                  .      THEN EXIT (IVIOL$);
 1244.  005671L 00110001 11011100              TSTIP   ,SWUSER,PSWI
        005672L 01000101 00000100
 1245.  005673L 11010010 00101001              BRA     IVIOL5,FZ
 1246.  005674L 11011100 01000011              MBWATT
 1247.                                  .      IF ODD IMP
 1248.  005675L 11011010 00110100              BRA     UBOUT,F#,IO
 1249.                                  .      THEN BEGIN
 1250.                                  .           STB (DIMP);                        111, 113 CODES
 1251.                                  .           IF ZERO IMP
 1252.                                  .           THEN URB := MBIN (URA)             111 145 - UBIN
 1253.                                  .           ELSE URB := MBIN2 (URA)            113 145 - UBIN2
 1254.                                  .           END
 1255.  005676L 00110111 00001001              STB     DIMP
 1256.  005677L 00110001 11010000              LDPP    MIFADR,URI+URA
        005700L 00110111 00100110
 1257.  005701L 11011000 00111011              BRA     UBIN2,F#,IZ
 1258.  005702L 00110111 00101001              STB     MIFSTB
 1259.  005703L 11011111 00111001              BRA     UBIN
 1260.  005704L                         UBIN2
 1261.  005704L 00110111 00101010              STB     MIFSTB2
 1262.  005705L 11001110 11111111              NOOP
 1263.  005706L                         UBIN
 1264.  005706L 11011100 00111001              MBIN
        005707L 00110001 00010101
 1265.  005710L 00110111 10000001              LDPT    URO+URB
 1266. >005711L 01011001 11111111              BRAX    FETCHI
       >005712L 11001111 11111111
 1267.                                  *
 1268.                                  .      ELSE BEGIN
 1269.  005713L                         UBOUT
 1270.                                  .           IF ZERO IMP
 1271.                                  .           THEN MBUS (URA,,URB)                  145 - MXIOUT
 1272.                                  .           ELSE MBUS2 (URA,,URB)             062 145 - MXIOUT
 1273.                                  .           END;
 1274.  005713L 00110001 11010000              LDPP    MIFADR,URI+URA
        005714L 00110111 00100110
 1275.  005715L 00110001 11010001              LDPP    MIFDAT,URI+URB
        005716L 00110111 00100111
 1276.  005717L 11011000 00101100              BRA     UBOUT2,F#,IZ
 1277.  005720L 00110111 00101001              STB     MIFSTB
 1278. >005721L 01011001 11111111              BRAX    FETCHI
       >005722L 11001111 11111111
```

```
  005723L                              UBOUT2
  005723L 00110111 00101010                     STB     MIFSTB2
 >005724L 01011001 11111111                     BRAX    FETCHI
 >005725L 11001111 11111111
                                       *       RETURN (FETCHI)
                                       *       END MXIO;
                                       *
 >005726L 01011001 11111111            IVIOL5   BRAX    IVIOL$
 >005727L 11001111 11111111
                                       *
```

```
                                          *
         005730L                          INFO:
                                          . 2,55    (    010)  NOP               NO-OP (STROBE ON 2200)
                                          . 5,40    (111 010)  INFO              A = VERSION #, B = REVISION #
                                          . 5,95    (062 010)  INFO2             B = CAPABILITIES, CDE=0
                                          . 5,95    (113 010)  INFO3             BCDE = 0  (CAPABILITIES)
                                          . 5,95    (174 010)  INFO4             BCDE = 0
                                          . 5,95    (115 010)  INFO5             BCDE = 0
                                          . 5,95    (176 010)  INFO6             BCDE = 0
                                          . 5,95    (117 010)  INFO7             BCDE = 0
                                          . 5,95    (022 010)  INFO8             BCDE = 0
                                          .
                                          .         CASE IMP OF
                                          .         0:    ;
                                          .         1:    A= VER
                                          .               B = REV;
                                          .         2:    B = CAPABILI
                                          .               C,D,E = 0;
                                          .         3,.8:B,C,D,E = 0;
                                          .         END CASE
                                          .         FETCHI
                                          .
         005730L 11011001 00011000                BRA     INFNO,T*,IZ
         005731L 00110111 00001001                STB     DIMP                  CHECK IF ITS 1 (111)
         005732L 01010001 00000010                LDTI    VER                   (ASSUME SO)
         005733L 11011000 00100000                BRA     INFEXT,F*,IZ          NO SEE IF 2 OR ABOVE
         005734L 00110111 10000000                LDPT    UR0+URA
         005735L 01010001 00001001                LDTI    REV                   SET PROCESSOR VERSION AND REVISION LEVEL
         005736L 11011111 00011001                BRA     INFEND
                                          .
         005737L 00110111 00001001        INFEXT  STB     DIMP                  CHECK IF ITS 2 (062)
         005740L 01010001 00000000                LDPI    UR0+URC,0
         005741L 00110111 10000010
         005742L 00110111 10000011                LDPT    UR0+URD               SET CDE = 0 IN ANY CASE
         005743L 00110111 10000100                LDPT    UR0+URE
         005744L 11011000 00011001                BRA     INFEND,F*,IZ          WAS IT 062 OR OTHER?
         005745L 01010001 11001101                LDTI    CAPABILI              YES, 062 SET CAPABILITIES
         005746L 00110111 10000001        INFEND  LDPT    UR0+URB               SET B-REGISTER
        >005747L 01011001 11111111        INFNO   BRAX    FETCHI                AND DONE
        >005750L 11001111 11111111
```

```
                                      *
005751L 01011001 11110110             MEMPF5   BRAX   MEMPF4
005752L 11011111 10000110
                                      *
005753L 11111111 11111111                      TABPAGE FLEXL
005754L 11111111 11111111
005755L 11111111 11111111
005756L 11111111 11111111
005757L 11111111 11111111
005760L 11111111 11111111
005761L 11111111 11111111
005762L 11111111 11111111
005763L 11111111 11111111
005764L 11111111 11111111
005765L 11111111 11111111
005766L 11111111 11111111
005767L 11111111 11111111
005770L 11111111 11111111
005771L 11111111 11111111
005772L 11111111 11111111
005773L 11111111 11111111
005774L 11111111 11111111
005775L 11111111 11111111
005776L 11111111 11111111
005777L 11111111 11111111
                                      *
002000                                FLEXLEN  EQU    $-FLEXP
004000                                         USE    FLEXL
004000                                         SKIP   FLEXLEN
                                               END
```

```
         AC             104     114     408     410     412     414     426     428     430     432     470     472
                        474     480     482     484     851     855     991    1124    1197
010017   ACCTL         *77!A
010015   ACD           *74!A
010017   ACPH          *76!A
010016   ACPL          *75!A
000001   APF            *9!A  120!A     232     239     255     259     285     289     501     513     916     920
                        943     962     969
010014   APFRK         *68!A
010013   APFRP         *67!A
010016   APFTK         *70!A
010015   APFTP         *69!A
         B6            123!A
004322   BINDEL        *379     207     272     278     570     597     682     686
004371   BINDER        *439     407     425
004400   BOTINS        *446     553     701     703
020006   BR            *42!A    103     150     153     169     171     176     178     197     198     200     206
                        217     223     270     404     422     476     486     561     582     633     681     699
                        735     742     744     753     754     755     762     764     766     779     781     806
                        807     818     819     826     827     834     835     836     854     856     863     864
                        871     872     879    1034    1042    1059    1087    1090    1099    1101    1107    1125
                       1151    1154    1157    1246    1264
         C0             851    1197
         C1             439     855    1043
000100   CAP55IO      *123!A  126!A
000315   CAPABILI     *126!A   1324
000010   CAPAPF       *120!A  126!A
000004   CAPBLUE      *119!A  126!A
000200   CAPCOM       *124!A  126!A
000000   CAPCYNT      *121!A  126!A
000000   CAPGUPY      *118!A  126!A
000001   CAPMICR      *117!A  126!A
000000   CAPRIM       *122!A  126!A
         CC             102     108     114     360     366     370     374     402     419     435     468     637
                        924     930     942     987     991    1046    1090    1106    1126
007000   CDOR         *134!A
006000   CDOX         *133!A
         CF             101     105     114     146     150     151     153     169     176     177     178     197
                        198     199     200     206     209     235     251     270     274     280     287     293
                        295     310     311     356     357     362     363     364     367     369     370     372
                        373     374     436     439     465     466     478     508     542     552     562     583
                        627     653     654     656     657     658     681     684     688     699     700     702
                        735     742     753     754     755     761     762     763     764     765     766     779
                        780     781     790     806     807     808     809     818     819     826     827     834
                        835     836     852     853     856     858     863     864     871     872     888     908
                        936     973     983     984     986     988    1004    1034    1038    1042    1043    1059
                       1071    1072    1076    1077    1080    1087    1099    1100    1124    1151    1154    1157
                       1182    1183    1184    1187    1188    1197    1217    1218    1219    1225    1226
030011   COMMODE       *96!A
004262   CRCGEN        *314     252     271     509
004255   CRCGENX       *304     219     544     554     573     601
004264   CRCGENY       *358     312
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004053   DBLRED       *162      808
         DE2MRH        982     1186
         DE2MRL        982     1186
         DIMP         1255     1312     1319
         DMAR          945
004024   DONIO        *131      177      780
005023   DOREAD       *795
005217   DOWDCG       *878      843
005134   DOWRITE      *841      791
         FCINDT        206      270      560      569      581      596      681     1099
         FCINST        169      742
         FCLEAR        153      178      200      735      764      781      835
         FCOINT        150      176      198      762      779      807
         FCOMOD        105      856
         FCOSYL        754      819      827
         FCOSYM        753      818      826
         FCOTDP        755      834      863      871
         FCOTUP        197      806     1034     1059     1151
         FCOUTC        528      540      551      699     1042     1087     1090     1154     1157
         FCRHDR        766
         FCRTIM        836
         FCWDCG        888
         FCWDGP        872
         FCWRTN        864
005303   FDATA        *963      904
005312   FDATA1       *975      967
         FDDBL        1053
004640   FDEOT        *693      674
005547   FDEWPI      *1144      706
004656   FDEWPIX      *706      696
004547   FDF          *614      509      531      573      604
004441   FDFCNS       *498      586      611
004516   FDFINC       *572      563
004536   FDFINP       *599      584
004545   FDFIS        *606      544      554
004567   FDFLEND      *639      627      636
004560   FDFNXT       *632      626
004531   FDFTBL       *594     1124     1128
005352   FDINIT      *1019
         FDLTD        1069
         FDMASK       1123
         FDNINV        673     1082
         FDNOT         695
         FDOUT         966     1026
004663   FDRCRC       *720      685      689
005420   FDRDBL      *1056     1054
004660   FDRDTA       *712      571      598      683      687
005415   FDREG       *1049     1031
005545   FDRSYNC     *1135     1102     1108
         FDSMSK        990
005352   FDTBL       *1014      991
004615   FDTEND       *665      644     1009
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005345  FDTENX        *1008    1012
005532  FDTFCN        *1116    1013     1027     1047     1091
005614  FDTFIN        *1161     691     1011     1147
004636  FDTFIX         *690     703
005374  FDTINI        *1039    1044
005505  FDTINVR       *1098    1083
005453  FDTLTD        *1079    1074
005444  FDTNRM        *1075    1070
        FDWPI          1030    1146
005620  FENDIR        *1172     717      725     1141
005641  FENDIT        *1192    1005
        FETCH          1200
        FETCHI         1221    1227     1266     1278     1281     1326
        FFDBL           800     858
        FFMASK          931     965
        FFRDLTD         813
        FFRMSK          295     790
        FFSMSK          881
        FFSYNC          932
        FFWMSK          842
        FIINDX          108
        FINUM           101
        FIPNTR          167
        FITROK          135     191
        FKLOFF          153     200
        FKLON           764     781
        FKMAST          153     200      764      781      835
        FKPNTR          178
        FKRWMF          735
004000  FLEX         *132:A      49
004000  FLEXL           *51      53      443      771     1330
002000  FLEXLEN       *1332    1334
004000  FLEXP           *53    1332
        FMINDX          176     198      762      779      807
        FMPNTR          198     807
        FMTRER          176     762      779      807
        FMTROK          176     762      779      807
        FO43MGC         851
        FO43MSK         852
        FODR0           104     930
        FOLOAD          104
        FPLHDR          766
        FPLRDTA         836
        FPLWDBL         872
        FPLWSGL         864    1151
        FPTHDR          755
        FPTRDTA         806     834     1059
        FPTRKH          197
        FPTWDBL         871
        FPTWSGL         863    1034     1151
        FRBUSY          125     138      908      930      973
        FRDRV           102     853      929
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            FRINDX          125
            FRIXCT          114     934
            FRIXCX          934
            FSGAP           170
            FSONLN          743
    005231  FXIO           *894
    005265  FXIO1          *935     933
    004022  FXIOER         *122     745     748
    005652  FXSTAT        *1205
    004107  HDRCHK         *186     765
    004171  HDRCHK1        *233     199
    004140  HDRCOM         *201     252
    004212  HDRCRC         *256     251
    004675  HDREAD         *737     136     192     208     218     224     249     273     275     279     281     294
                            296     880     882
    004666  HDRERD         *730     116     168     172
    005000  HDROK          *775     297
    004253  HDROKX         *297     292
    004021  HDSTRT         *115     942
            HL2MRH          985
            HL2MRL          985
            IMAR            507     603     607     911
    005746  INFEND        *1325    1317    1323
    005737  INFEXT        *1319    1314
    005747  INFNO         *1326    1311
    005730  INFO          *1290
    020005  IO              *41:A  1248
            IT              439    1043
            ITW             274     280     287     293     684     688
            IVIOL$         1285
    005726  IVIOL5        *1285     902    1213    1245
    020004  IZ              *40:A   904    1221    1257    1276    1311    1314    1323
    010001  KBSCNT          *49:A
            LIMP            949
    030000  LINK            *82:A   310     356     375     402     437     439     440     465     491     991     992
            LUF             950    1197
    010003  MADR            *54:A   105     150     153     169     176     178     197     198     200     206     270
                            637     654     681     699     735     742     753     754     755     762     764     766
                            779     781     806     807     818     819     826     827     834     835     836     856
                            863     864     871     872     888     924     986     988    1034    1042    1059    1087
                           1090    1099    1126    1151    1154    1157    1184
            MARIH           984    1188
            MARIL           984    1188
            MAROH           234     257     921
            MAROL           234     257     921
    010004  MBITS           *55:A   102     114     146     295     790     809     853     858     908     930     936
                            973    1217    1226
    004000  MBPAGE          *94
    010005  MBSTAT          *56:A   109     151     177     199     229     251     627     638     653     765     780
                            808     942     987    1124    1130    1183    1225
    004000  MBSTRT          *99     951
    010006  MCRCH           *57:A   274     311     357     362     363     369     372     508     657     658     684
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                           700       763       983       984      1071      1076      1187      1188
010007  MCRCL            *58:A       280       363       364       374       657       658       688       702       761       983       984
                          1071      1076      1187      1188
        MDR                237       287       506       541       552
010010  MDSKS            *59:A       209       235       287      1219
010011  MDSKT            *60:A       235       851      1218
        MDW                600       922       946
004571  MEMPF4            *651       602       634      1129      1328
005751  MEMPF5           *1328       944
004022  MEMPFDS           *120       233       236       256       286
        MIFADR             105       150       153       169       176       178       197       198       200       206       270       528
                           540       551       560       569       581       596       681       699       735       742       753       754
                           755       762       764       766       779       781       806       807       818       819       826       827
                           834       835       836       856       863       864       871       872       888      1034      1042      1059
                          1087      1090      1099      1151      1154      1157      1256      1274
        MIFDAT             104       150       153       176       178       197       198       200       477       487       529       541
                           735       753       754       755       762       764       766       779       781       806       807       818
                           819       826       827       834       835       836       855       863       864       871       872      1034
                          1042      1059      1087      1090      1151      1154      1157      1275
        MIFIN              171       217       223       405       423       561       582       744      1101      1107      1264
        MIFSTB             105       150       153       169       176       178       197       198       200       215       221       401
                           418       477       490       530       543       560       581       735       742       753       754       755
                           762       764       766       779       781       806       807       818       819       826       827       834
                           835       836       856       863       864       871       872       888      1034      1042      1059      1087
                          1090      1099      1105      1151      1154      1157      1258      1277
        MIFSTB2           1261      1280
020002  MO               *38:A       233       236       256       286       602       634       944      1127
        MODW              1199
020003  MP               *39:A       233       236       256       286       602       634       944      1129
        MR2HLH             655      1185
        MR2HLL             655      1185
        MR2PCH             912
        MR2PCL             912
010013  MSECT            *62:A
010012  MTRAK            *61:A
005342  NOTYET           *1000       909       974
010000  PDLNP            *48:A
004027  PENDR             *143       127
000040  PRE               *3:A
000000  PROC            *130:A
002000  PROD            *131:A
        PSWI               901      1198      1212      1244
        PSWO              1198
010002  Q                *46:A       293       360       366       370       435       468      1046
030006  RCRCH            *93:A
030007  RCRCL            *94:A
030005  RDATA            *92:A
005105  RDDLTD            *829       820
005067  RDNORM            *823       814
005046  RDSGL             *811       801
000011  REV               *2:A      1316
030004  RPNTR            *91:A
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030003  RSTAT           *90:A
        SACRC           761          763
        SADUAL          753          754
        SB              621
010002  SCANSV          *50:A
        SCHUMS          228
        SCMBUS          228
        SDCRC          1076
        SDDUAL          826          827      1077      1078
        SL              360          366       370       435       468
        SMCRC          1071
        SMDUAL          818          819      1072      1073
        SMR             234          257       507       607      1119
        SOCLK           216          222       403       406       421       424       475       485       529      1154      1157
        SRVBSN          156          180       768       837       865       873       889
        SRVDO           230
        SRVREQ          228          635       643
        SRVRPT          659
        SVMSECT         257
        SVMTRAK         234          921
        SWRPT          1198
        SWUSER          901         1212      1244
030001  TEMP1           *83:A        85:A      101       108       311       419       436       466       478       542       552       562
                        583          700       702       852       855      1004      1038      1043      1182      1197
030002  TEMP2           *84:A        86:A      362       364       367       370       373
030001  TEMPH           *85:A        656       658      1080      1087      1100
030002  TEMPL           *86:A        656       658      1072      1077      1090      1106
000001  TYPE             *5:A        12:A      117:A     119:A     124:A
005706  UBIN          *1263         1259
005704  UBIN2         *1260         1257
005671  UBIO          *1235
005713  UBOUT         *1269         1248
005723  UBOUT2        *1279         1276
        UDEH            656          657       983      1187
        UDEL            656          657       983      1187
        URA             924          988      1217      1256      1274      1315
        URB             628          673       931       965       990      1025      1069      1082      1123      1167      1265      1275
                       1325
        URC             621          929      1035      1057      1320
        URD             922         1218      1321
        URE             946         1219      1322
        URH             653          987      1183
        URI             621          628       653       654       656       673       922       924       929       931       946       965
                        988          990      1025      1069      1082      1123      1167      1183      1184      1256      1274      1275
        URL             654          986      1184
        URO             621          628       657       983       986       987      1025      1035      1057      1167      1187      1217
                       1218         1219      1265      1315      1320      1321      1322      1325
030012  URPNTR          *97:A
030010  UXPNTR          *95:A
000002  VER              *1:A       1313
005177  WDBL           *868          859
030016  XCRCH          *101:A
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 030017  XCRCL          *102:A
 030015  XDATA          *100:A
 030014  XPNTR           *99:A
 030013  XSTAT           *98:A
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